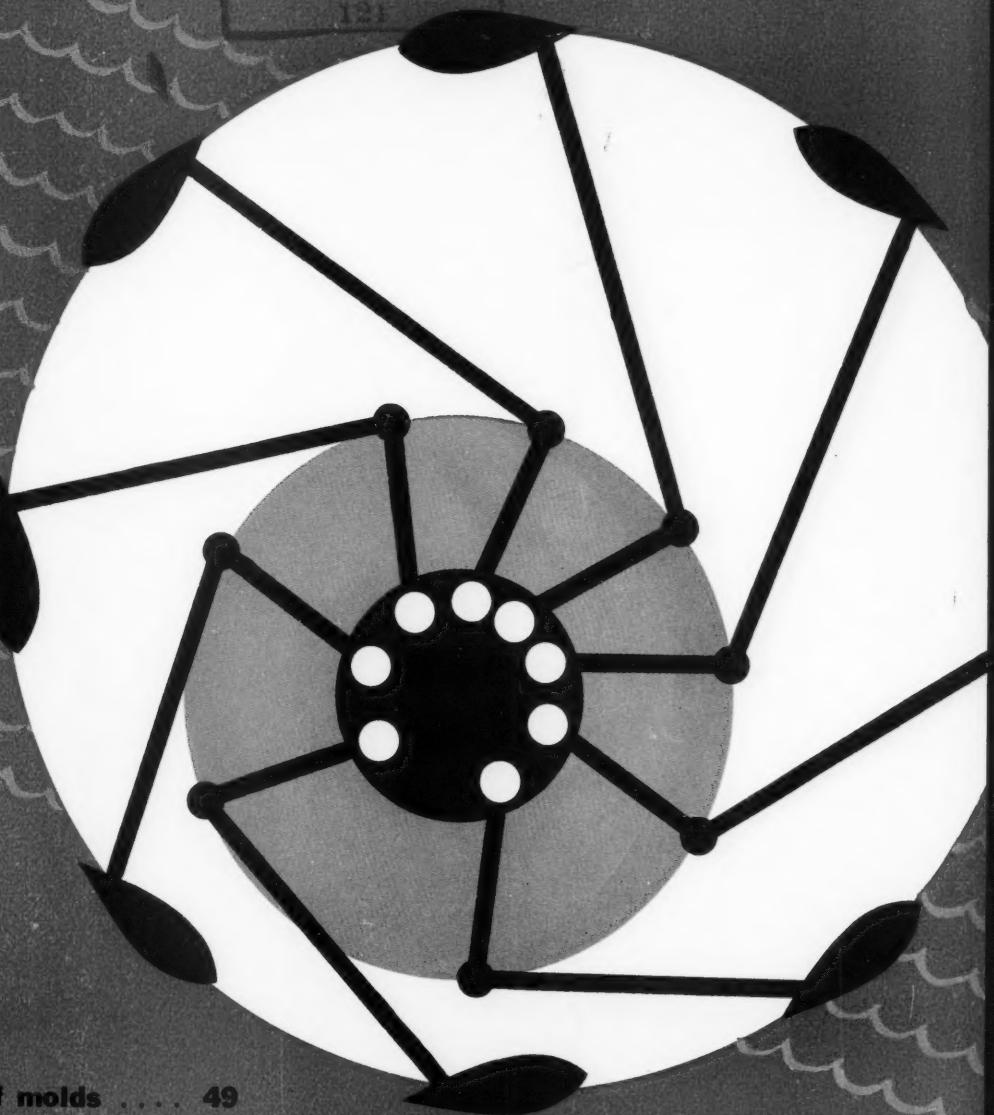


# Design Engineering

FIVE DOLLARS A YEAR

ROOM  
APRIL 9 1958

121



April 1958

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**"Aluminum!  
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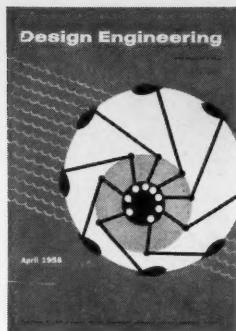
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### This month's cover

Back in the cover position for the April issue is Gerald Bern (April '57, page 3) with a contribution on the subject of cycloidal propulsion. The tarantula-like result stems from the driving arms and vanes of this interesting system, plus a little artistic licence. Done up in a smart color and with some wavelets thrown in, the whole makes for an eyecatching cover.

### Design Engineering

MEMBER

CCAB

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# Design Engineering

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APRIL 1958

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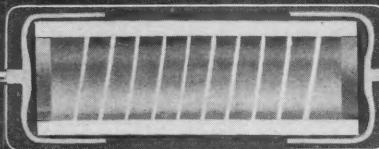
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|----------------------|-----------------|

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 Model 9852 -  $\frac{1}{2}$  watt at 125°C 1% or .5%  $\pm$  50 or  $\pm$  25 ppm  
 Model 9853 - 1 watt at 70°C 1% or .5%  $\pm$  50 or  $\pm$  25 ppm  
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WESTON VAMISTOR PERFORMANCE DATA  
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| Characteristic                                 | Vamistor<br>production units                            | MIL-R-19074A<br>(ships)<br>Style RI-94 | Wirewound<br>MIL-R-93A<br>Style RB-52<br>Char. A | Film<br>MIL-R-10509B<br>Style RN-70<br>Char. A |
|--|---|--|--|--|
| Short Time Overload<br>2.5 Times—10 min        | Average $\pm$ .01%<br>Low $\pm$ .00%<br>High $\pm$ .06% | .5% max.                               | .5% max.   | .75% max.*                                     |
| Load Life<br>1000 hr—85°C                      | Average $\pm$ .15%<br>Low $\pm$ .10%<br>High $\pm$ .20% | .5% max.                               | .5% max.   | 1.0% max.**                                    |
| Low Temperature<br>-65°C—24 hours              | Average $\pm$ .00%<br>Low $\pm$ .02%<br>High $\pm$ .02% | .5% max.                               | (no test)  | 1.0% max.                                      |
| Moisture Resistance<br>MIL-STD-202, Method 106 | Average $\pm$ .23%<br>Low $\pm$ .15%<br>High $\pm$ .36% | .5% max.                               | 1.0% max.  | 3.0% max.                                      |
| Salt Water Immersion<br>0 to 85°C—5 cycles     | Average $\pm$ .04%<br>Low $\pm$ .02%<br>High $\pm$ .10% | .5% max.                               | .5% max.***                                      | (no test)                                      |
| Temperature Cycle<br>-55 to 85°C—5 cycles      | Average $\pm$ .04%<br>Low $\pm$ .02%<br>High $\pm$ .07% | .2% max.                               | .2% max.   | 1.0% max.                                      |
| Insulation Resistance<br>100 v d-c             | Greater than<br>10,000 megohms                          | 100 megohms<br>min.                    | 50 megohms<br>min.                               | 10,000<br>megohms min.                         |
| Dielectric Strength<br>900 v rms—1 minute      |   | .05% max.                              | .05% max.  | .5% max.                                       |
| Terminal Strength                              | { Below measurable<br>value—all samples                 | .5% max.                               | (no limit)                                       | .5% max.                                       |
| Effect of Solder                               |   | .5% max.                               | (no test)  | .5% max.                                       |

\*MIL-R-10509B test 2.5 times—5 seconds

\*\*MIL-R-10509B test at 70°C ambient

\*\*\*MIL-R-93A test not cycled, 25°C—24 hours

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MELDRUM

E. J. Meldrum (Looked at plastics for your tooling?) is co-author in this issue with J. R. Morris.

With 20 years of tooling field experience he's an authority worth reading. Mr. Meldrum is with Canadair in Montreal, where he has charge of their plaster pattern and plastic tooling shop.



MORRIS



MACPHERSON

K. R. Macpherson (Propulsion system eliminates a rudder) is the editor of an insurance magazine and spare-time expert on shipping subjects. Wartime telegraphist with the RCNVR, he studied anthropology at U. of T. and has been cab and bus driver, timber cruiser, archaeologist and (of all things) guinea-pig for mosquito-repellent tests.



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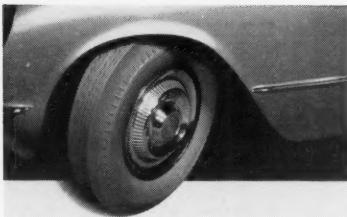
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# Reports

A news roundup of items of engineering and design interest from the world over

## Rubber that can withstand 500 deg. F. "storage"



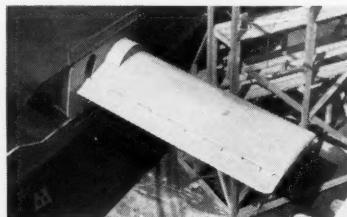
One of the interesting new products of rubber engineering will be on show at Chicago's Design Engineering show mid-April in the form of silicone rubber tires. These are capable of "storage" at temperatures as high as 500 deg. F., and are particularly well suited to supersonic aircraft. Even now, the wheel wells in certain planes require extensive, weight-consuming installation or even refrigeration to protect their conventional rubber tires from frictional temperatures generated at supersonic speeds. The model shown was molded in a standard auto tire press for the sake of laboratory convenience.

## Light alloy furniture invades the schoolroom



"Things have sure changed since I was at school." We have all said it, and in the field of classroom furniture it couldn't be truer. Gone are the days of back-breaking benches and inconvenient desks. With cast aluminum as the main components of these units, clean simple lines are obtained which provide attractive styling and appearance. The chairs are readily stackable for space-saving and the extra heavy aluminum hinges running the full length of the desk top should give it a fighting chance against boisterous handling by schoolchildren.

## Fins steady an experimental ship for missile launching



An important consideration in the design of the U. S. Navy's experimental ship, the Campus Island (and a forerunner of a fleet of nuclear-powered, ballistic missile-launching vessels) was stability. The Campus Island will roll less than one tenth as much as her sister ships in the same seaway because of her stabilizers. This control is accomplished by underwater fins, one on each side of the vessel, approximately midway bow and stern. Action of the fins is automatically controlled from the bridge by instruments which measure roll rate, roll angle and roll acceleration. The fins retract in hull recesses when not in use.

## Change the oil when you trade in your car?



The little oxidation inhibitor shown at left is a device developed by the National Research Council in Ottawa and is now licensed to a Toronto firm. It consists of a small cannister secured to a plug (intended to take the place of the regular crankcase oil-pan drain plug in an automotive engine.) The cannister contains calcium and a sodium alloy. Its purpose is to prevent oxidation of the crankcase oil (leading to gumming and varnish formation) and continually replenish the detergent in the crankcase oil. Claim for the device is the extension of the life of crankcase oil from 1,000 or 2,000 miles to no less than 20,000 miles.

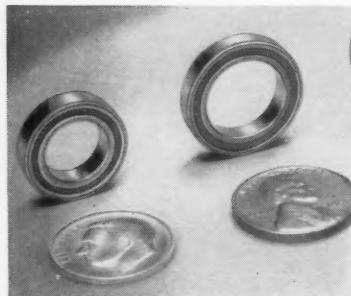
## A Paul Bunyan among the pipe benders



Talk of pipe bending and you are not likely to think of 24-inch pipes with half-inch walls. A Vancouver firm was asked to think along these lines, however, and the machine illustrated is their answer to just such a job.

Calculations indicated that a structure would be required to induce a bending moment at the point of bending of 840 ft. tons. To control the out-of-round at the point of bending, two 60-ton hydraulic jacks were chosen and arranged so as to make them self-compensating (the more power required to form the bend, the tighter the pipe is gripped to prevent out of round). Of fabricated steel construction, the mighty muscled bender weighs eight tons complete.

## Miniaturization puts the pinch on ball bearings



There's hardly a component currently marketed that hasn't been tapped on the shoulder in the last few years by the delicate hand of miniaturization. The ball bearing is no exception to the trend.

The picture at the left shows the length to which such minification can be taken. Some of the sizes in this new range require less than 15% of the volume required by counterpart bore sizes in conventional bearings. Although by no means the smallest bearings marketed (they really bridge the gap between true miniature bearings and conventional inch series instrument bearings) this new series scores by virtue of its extremely thin cross-section dimension. They should be received with open arms by design engineers whose bearing problem is one of space rather than load.

## That bubble car you saw. What makes it go?



Subject of many "the-martians-have-landed" comments, the British-built BMW Isetta shrugs off such sly remarks and continues to sell well as Canada's first "bubble-car." Contrary to some theories, the little two-seater is not powered by mice chained to a treadmill but does, in fact, employ a sturdy 18.30 cu. in. air-cooled engine as powerplant.

Offering weatherproof transportation for two, easy parking (there are more than two and a half Isettas to the '58 Lincoln) and 70 mpg., the midget has a single front-opening door and is able to hustle over the highways at 12 mph. over the legal speed limit in Canada. Design Engineering is currently digging up data on this business of passenger space to over-all length and will have some strong things to say in a future article on the subject. Watch for it.

## Cut down the waste. Get quartz the shape you want



Long-time problem for quartz users has been in the high wastage of material due to the fact that it was generally available only in standard cylindrical ingots.

A New Jersey firm would seem to have effectively put its finger on the trouble and is now prepared to forge fused-quartz blanks in such shapes as rods, tubes, briquets and prisms. In essence, the process involves reheating the material to a slushy state and then squeezing it into the desired shape. The closer the shape to that which is finally required — the less the wastage through grinding.

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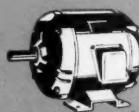
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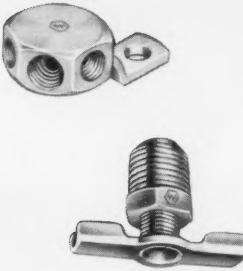
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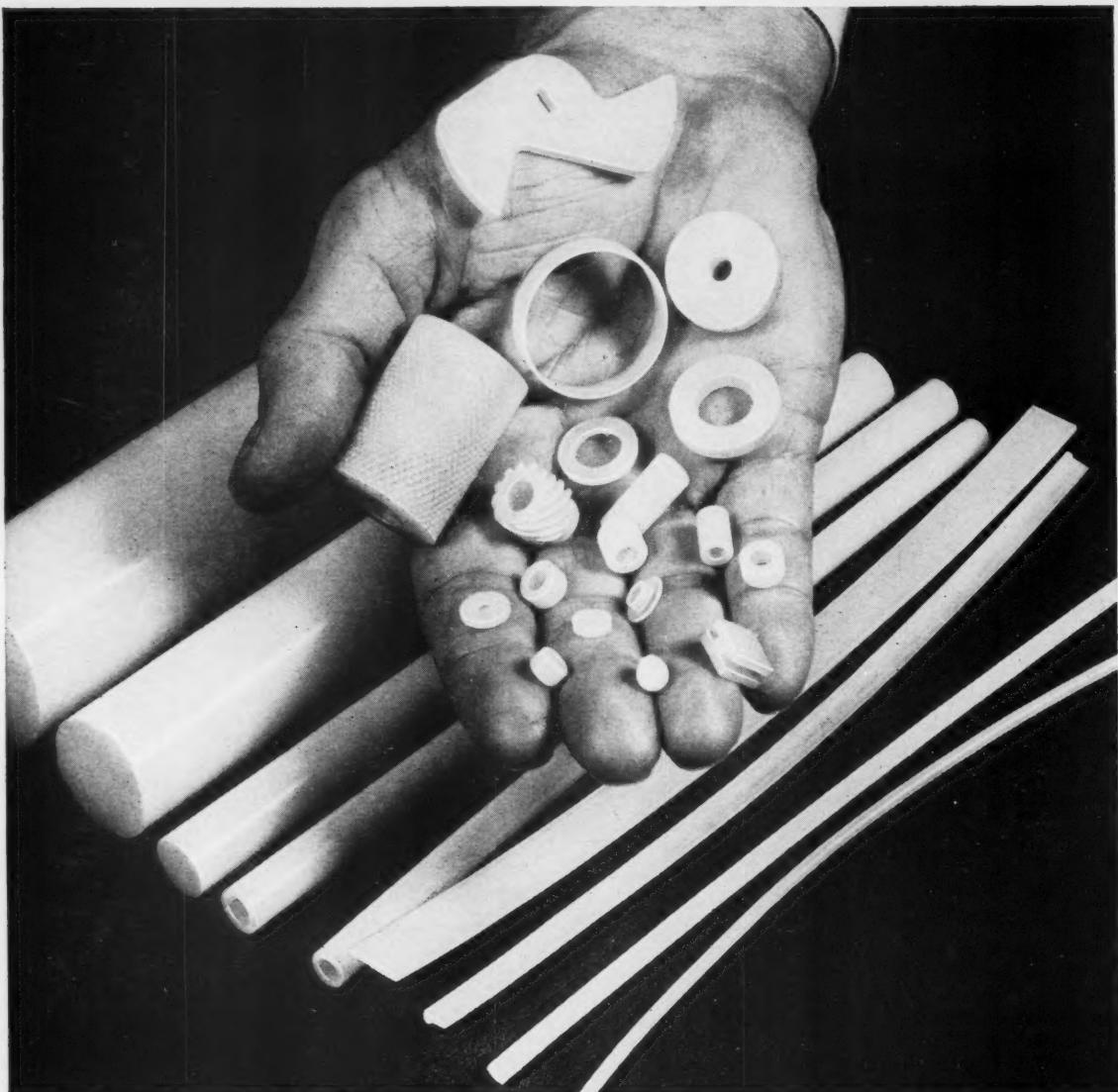
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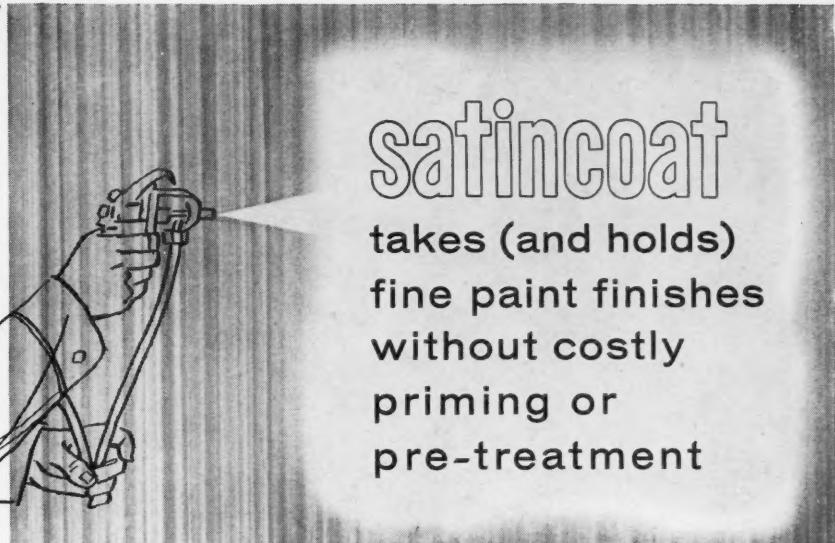
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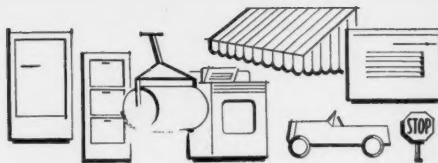
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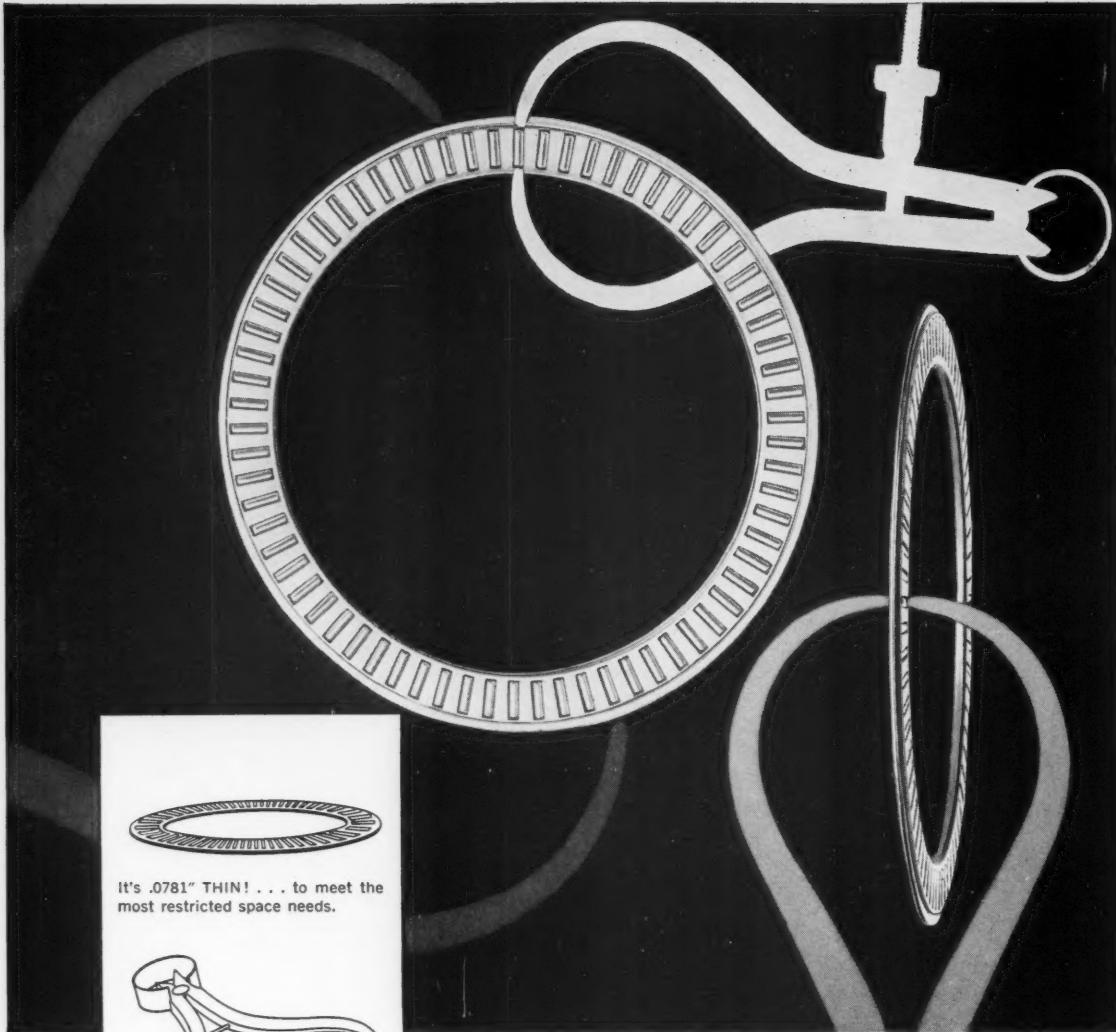
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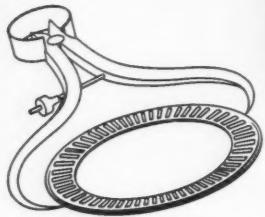
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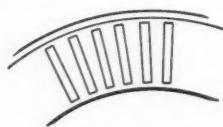
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1016-B

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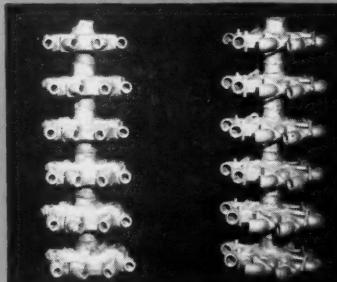
And Shawinigan PERMA-SPUN offers significant economies over drawn tubing. Even on small quantities of any

specific analysis the cost is low, and on large runs permanent molds can be used permitting a thinner wall and less machining allowance.

*Centrifugal Force* ensures complete freedom from non-metallic inclusions and shrinkage and creates a dense, fine-grained casting with enhanced physical properties.



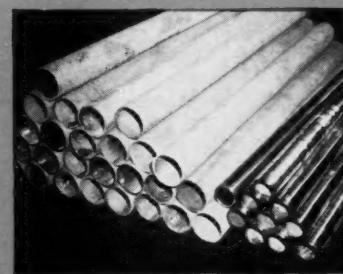
Centrifugally cast CF10M pipe for sulfite acid circulation systems.



Centrifugally cast stacks of CF8 fittings (as cast condition).



Centrifugally cast HU retorts for magnesium production.



Centrifugally cast radiant tubes and rolls for heat treating furnace — cast in permanent molds.

Illustrated are a few of the many applications of **PERMA-SPUN** corrosion and heat-resistant stainless steel. Consider the possibility of saving money in your operations with "Shawinigan" **PERMA-SPUN** centrifugally cast Stainless Steel!

\*Registered trade mark.

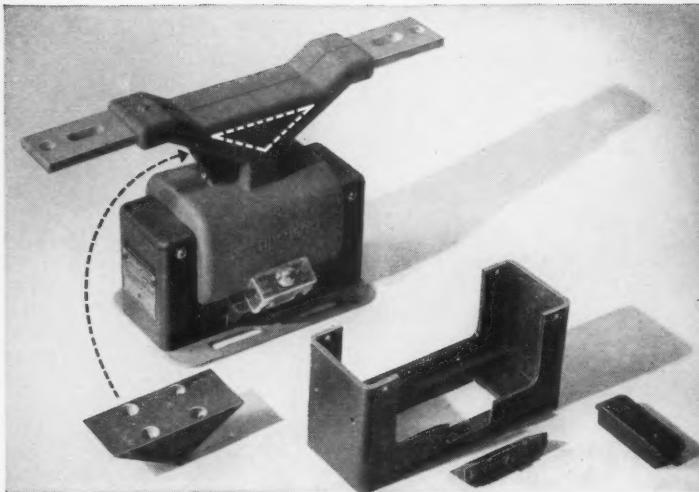


**SHAWINIGAN CHEMICALS LIMITED**  
STAINLESS STEEL AND ALLOYS DIVISION

Shawinigan Building, Montreal

505 Eglinton Ave. W., Toronto

# Design for LONG SERVICE LIFE-



**molded reinforced  
polyester adds  
electro-mechanical  
strength, high  
insulation value**

**Moldings of  
ATLAC  
THERMAFLOW  
reinforced polyester**

**Data for  
designers**

**Atlac Thermaflow 500**

Impact strength (Izod, notch) 10-16 ft. lb./in.  
Flexural strength . . . 18,000-23,000 psi.  
Compressive strength . . . . 21,000 psi.  
Tensile strength . . . . 5,000-9,000 psi.  
Mod. of elasticity . . . .  $1.9 \times 10^6$  psi.  
Heat distortion, 264 psi. . . . over 500° F

*For data on all Atlac Thermaflow materials, write for a copy of our new catalog.*

The new line of Westinghouse current transformers for indoor metering or relaying applications is smaller and approximately 20% lighter than ever before—yet has a rating factor of 1.5 overload, continuous operation.

Five molded reinforced polyester pieces by the Carl Zehr Company, Ashtabula, Ohio, contribute to the electrical and mechanical strength, light weight, compactness and modern appearance of this new Westinghouse line.

The case, terminal block and end caps are molded of Atlac Thermaflow 2400. Strong and light, this assembly has eliminated welding and strapping operations, thus facilitating assembly, and completely protects the coils from mechanical damage.

The "V" shaped block which acts as a spacer and fastening block for the primary terminals is of Atlac Thermaflow 500, a high-strength electrical grade material. Westinghouse insists on—and gets—full mechanical strength after exposure to 240°C. for one hour.

A variety of glass and nylon rag reinforced Atlac Thermaflow compounds are available to suit your specific material needs. Write for the new catalog.

**ATLAC  
THERMAFLOW**



**ATLAS POWDER COMPANY  
CANADA, LTD.**

Brantford, Canada

Offices in MONTREAL, TORONTO,  
EDMONTON, VANCOUVER



You can make almost anything better out of polyurethane foam. To make this remarkable material Reichhold supplies a complete and highly versatile system: POLYLITE 8601 — polyester resin, POLYLITE 8621 — polyisocyanate, and a catalyst. The system allows self-curing at room temperatures; yields a hard, rigid foam with a high strength-to-density ratio and exceptionally uniform structure of closed cells. Write to RCI for full details and suggested formulations. Ask for Technical Bulletin PR-15-R.

# REICHHOLD



Creative Chemistry...  
Your Partner in Progress

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol • Hydrochloric Acid • Formaldehyde  
Glycerine • Phthalic Anhydride • Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite  
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenol • Sulfuric Acid • Methanol

REICHHOLD CHEMICALS (CANADA), LTD. • 1919 Wilson Ave., (Weston), Toronto 15, Ontario

Overhead Garage Doors



Lawn Mowers



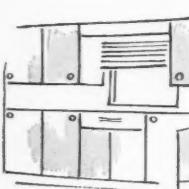
Playthings



Building Facades



Bus Bodies



Kitchen Equipment



Utility Tables



Store Fronts



Trailer Bodies



Picnic Coolers



Street Signs

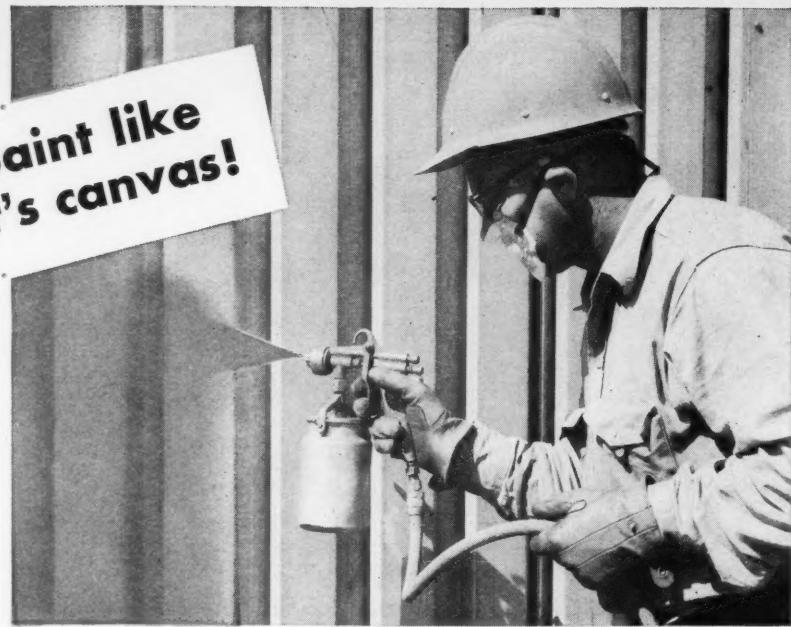


Fishing Tackle and Tool Boxes



Roof Decking

Holds paint like  
an artist's canvas!



"COLOURBOND"

CONTINUOUS

GALVANIZED STEEL SHEETS

The coating of pure zinc on Stelco's new "Colourbond" Continuous Galvanized Steel Sheets is applied by an exclusive technique developed by Stelco . . . it produces a soft lustre finish, perfectly suited to the close adhesion of paint and particularly acceptable when a bright surface spangle is not desirable.

No surface preparation is necessary, and no primer coat needed.

As with all other galvanized sheets produced by Stelco's patented continuous galvanizing process, the bond between the zinc and the steel is so tight that the sheets can be worked or formed to the limits of the base steel itself, without any sign of cracking or peeling of the zinc coating.

For every product or building application where a painted surface is required to combine with an anti-rust, anti-corrosion surface use Stelco "Colourbond" Galvanized Steel Sheets — available now, in sheets or coils.

For full information and metallurgical service,  
contact any Stelco Sales Office.

**THE STEEL COMPANY OF CANADA, LIMITED**

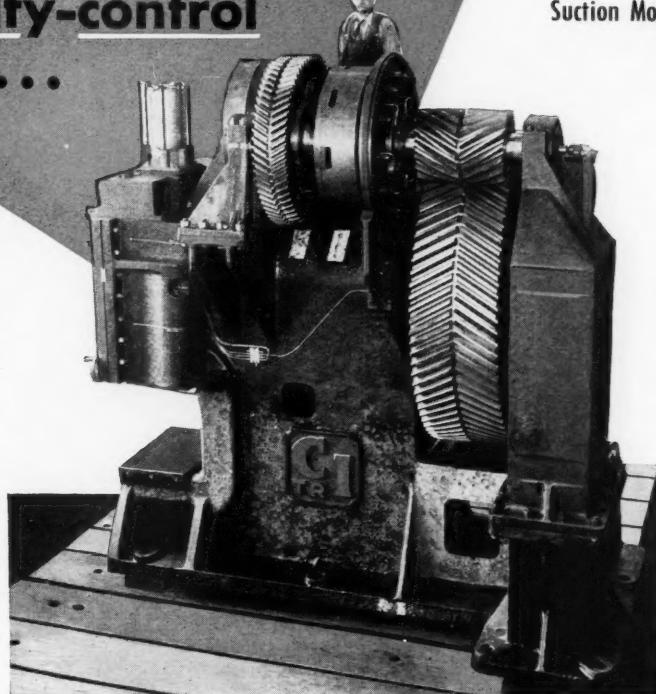
Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland.

57071.A

**CANADA  
IRON**  
*has a way...  
**the expert,  
 quality-control  
 way...***

**Rolling Mills  
 Tie Plate Shears  
 Plate Levellers  
 Presses  
 Barking Drums  
 Ore Crushers  
 Suction Moulds**



A 116,000 lb. Tie Plate Shear for a Canadian steel company is checked in Canada Iron's shops. Shown before assembly of gear guards and final painting, the huge tie plate shear incorporates a special air clutch for engaging the gears.

*with*

## MACHINE BUILDING

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 CANADA IRON FOUNDRIES, LIMITED

**Sales Offices** Montreal: 921 Sun Life Building, UNiversity 6-7841 • Toronto: 169 Eastern Avenue, EMpire 3-8801



**Don't let  
POTENTIAL SAVINGS  
slip through  
your fingers**

\*We'll be glad to add to this figure. Our creative people are constantly inventing and developing new fastening devices to meet specific requirements. Turn them loose on your problem. Many manufacturers have done so . . . and are profiting as a result.

Have you explored the full savings potential of Speed Nut spring tension fasteners in your assembly operation? There are more than 8000\* types and sizes available...and all are designed and engineered to save you money. Let us do a comprehensive fastening analysis of your product and show you how Speed Nuts can solve your fastening problems by doing the job better, faster and at lower cost. Call or write us today . . . and cash in on the full "saving power" of the complete line of Speed Nut fasteners.

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**DOMINION FASTENERS LIMITED**  
Hamilton, Ontario  
a Geo. A. Tinnerman corporation

**TINNERMAN  
SPEED NUTS**

# VIBRIN®

*molds better products  
more economically!*



## THE WORLD IS MADE OF VIBRIN

*at the Nova Scotia Museum of Science in Halifax*

There seems no end to the versatility of *Vibrin* polyester resins, reinforced with glass fibres. It's improving on wood and metal in one product after another . . . with important savings into the bargain!

*Vibrin* also reduces investment to a minimum because it uses inexpensive molds of wood, plastic or plaster, and heat and pressure are not needed. It offers great strength, light weight, corrosion resistance, and the colour can be built in!

*Made Here in Canada!* That means prompt delivery of any one of Naugatuck's wide choice of *Vibrin* liquid polyester resins. Feel free to call in our technical representatives or call on our development laboratories. Simply contact Naugatuck Chemicals at Elmira, Ont., or our branches in Montreal, Toronto, Winnipeg or Vancouver.

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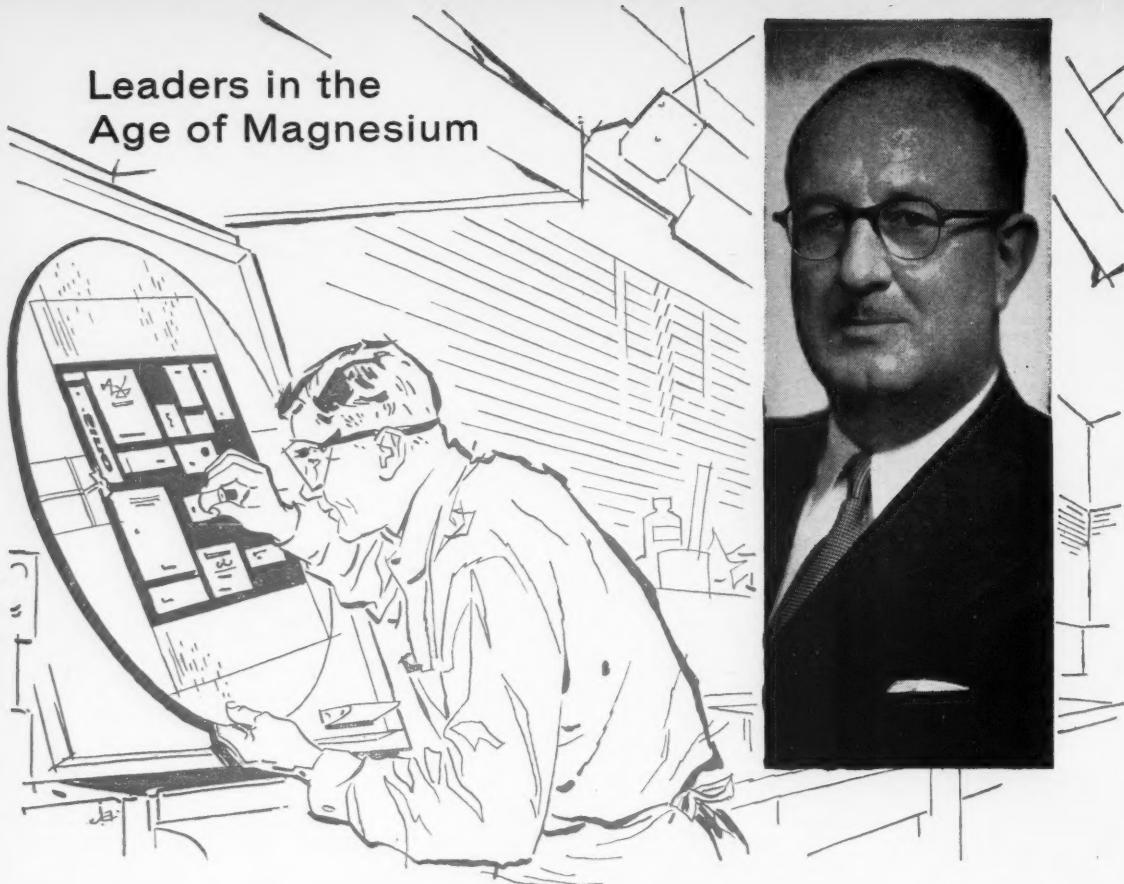
**VIBRAMIX**—Polyester Premixes  
**KRALASTIC**—Styrene Copolymers  
**MARVINOL**—Vinyl Resins



## Naugatuck Chemicals

Division of Dominion Rubber Company Limited — PLANT & SALES: Elmira, Ont.

**Leaders in the  
Age of Magnesium**



**"We have based our future on  
MAGNESIUM**

"We at Brooks and Perkins based our future on Magnesium a good many years ago. We have prospered. We have found that Magnesium will do a job in economic competition with other materials in a hundred different ways. Not only have our fabricating plants in Detroit been expanded, but we were able to install our own rolling mills in nearby Livonia. Metal dealers warehouse our products, and we have offices in New York, Washington, Los Angeles and Dallas.

"Domal High Purity Magnesium is contributing to the success of Brooks & Perkins' Magnesium Printing Plates. Our Magplate Division tells us that its high quality and uniformity gives almost as much advantage over our earlier plates as magnesium has over other metals.

Extract from a letter by  
Mr. Howard Perkins,  
President, Brooks and  
Perkins Inc., Detroit,  
Michigan.

**DOMAL  
HIGH-PURITY THE WORLD'S LIGHTEST, MOST VERSATILE METAL  
MAGNESIUM**

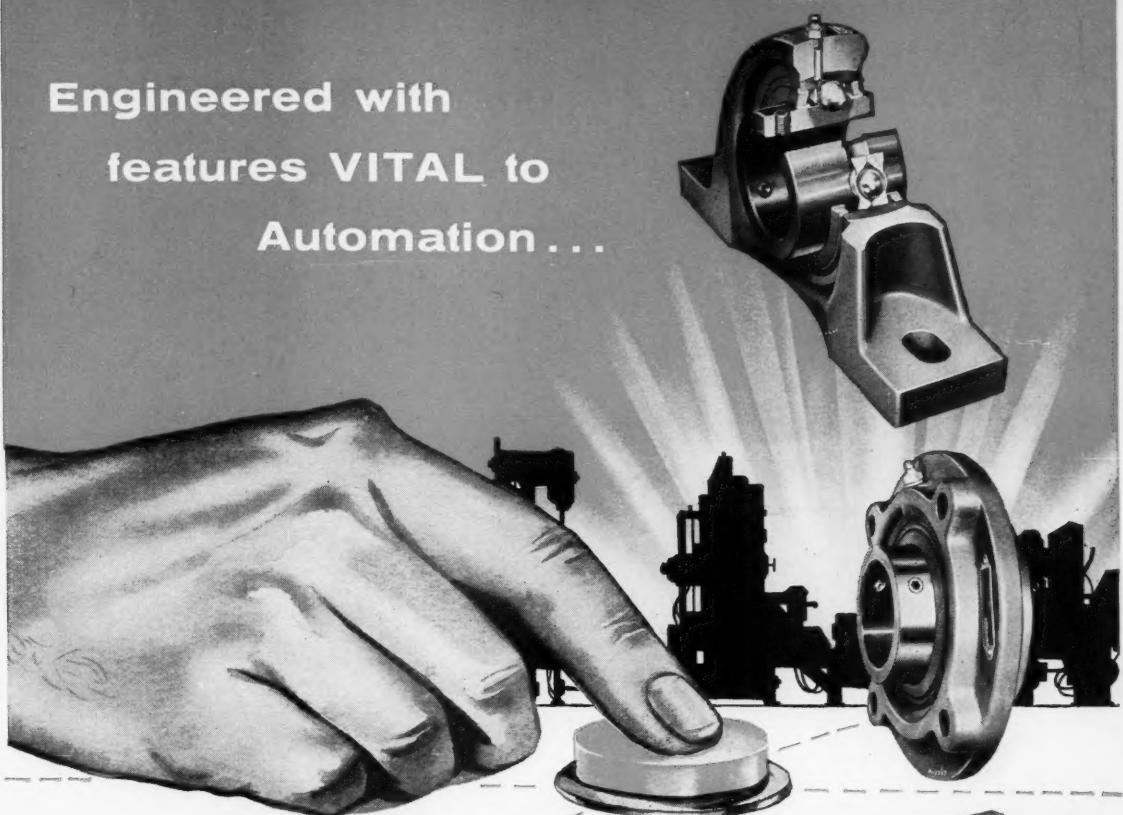


**DOMINION MAGNESIUM LIMITED**

320 BAY STREET • TORONTO, CANADA

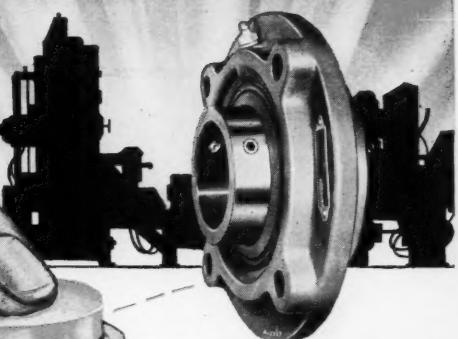
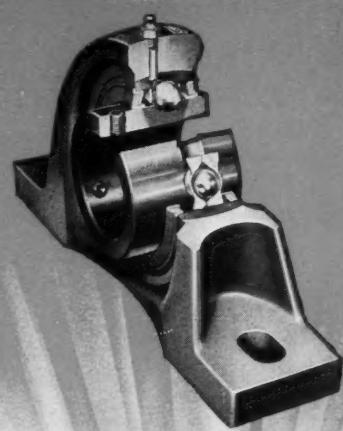
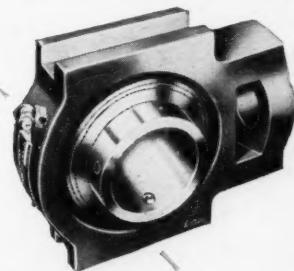
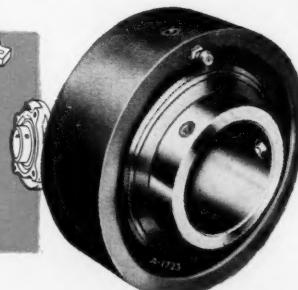
The original engravings for this  
advertisement were made on magnesium

**Engineered with  
features VITAL to  
Automation . . .**



## **SEALMASTER BALL BEARING UNITS!**

Automatic operation is the key to both lower unit production cost and increased quality. SEALMASTER Ball Bearing Units incorporate an exclusive combination of features to meet the requirements of today's automatic production. SEALMASTER engineers working closely with machinery manufacturers are constantly developing features to keep pace with tomorrow's production. You'll want full information on SEALMASTER'S exclusive combination of features—a vital factor in the quality and performance of the machinery you build or buy.



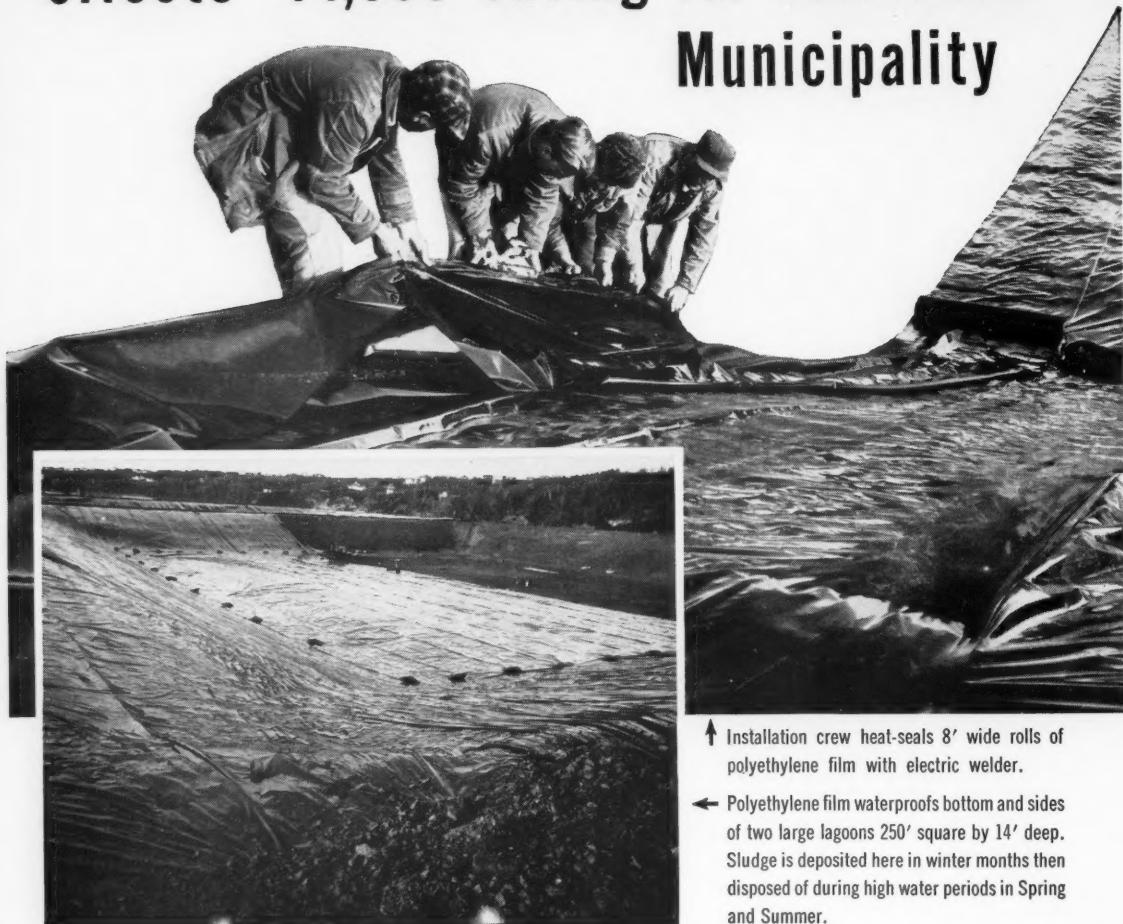
**Write for  
Bulletin 454.  
It's a must  
for your file.**



S240C

**SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO. OF CANADA LIMITED, BELLEVILLE, ONTARIO**

# 200,000 sq. ft. of Polyethylene film effects \$44,000 saving for Edmonton Municipality



↑ Installation crew heat-seals 8' wide rolls of polyethylene film with electric welder.

← Polyethylene film waterproofs bottom and sides of two large lagoons 250' square by 14' deep. Sludge is deposited here in winter months then disposed of during high water periods in Spring and Summer.

## Plastic Film made of "Bakelite" Polyethylene waterproofs large sludge lagoons ...

200,000 sq. ft. of plastic film, made of "Bakelite" polyethylene, was recently used to waterproof two large sludge lagoons of Edmonton's new \$7,000,000 sewage process plant. Believed to be the largest operation of its kind in Western Canada, this waterproofing job cost approximately \$6,000, using polyethylene film—as compared to an estimated cost for asphalt of \$50,000.

This film, made of "Bakelite" polyethylene, is tough, flexible, lightweight, non-absorbent, and economical to use. It is an inexpensive protective material for construction and outside storage, and to line water reservoirs in irrigation areas. Available in various width rolls, it is easily joined together for any covering size needed. Widely used, too, in the consumer packaging field, polyethylene film is truly "the fantastic plastic of 1001 uses."

## "BAKELITE" POLYETHYLENE

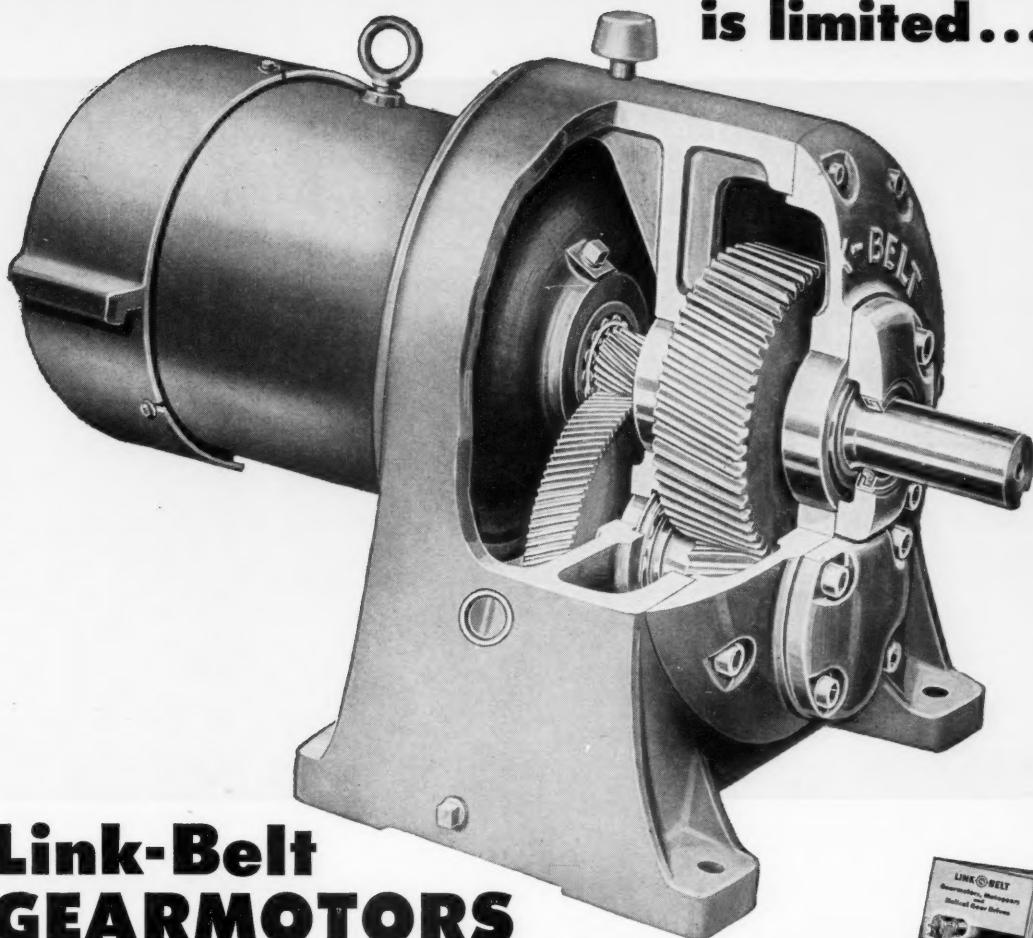
BAKELITE COMPANY  
TORONTO • BELLEVILLE • MONTREAL

Division of Union Carbide Canada Limited  
"Bakelite" and "Union Carbide" are registered trade marks



A CHIEF SUPPLIER OF PLASTIC RAW MATERIALS TO INDUSTRY

# Efficient speed reduction where space is limited...



## Link-Belt GEARMOTORS

With their integrally-mounted CEMA electric motors, Link-Belt Gearmotors are your economical answer to efficient speed reduction in minimum space. And to assure years of trouble-free service, they're built better these ways:

**BUILT-IN ALIGNMENT** of motors and gears results in lasting efficiency plus maximum safety. **HOBBED HELICAL GEARS** are rigidly mounted for smooth, quiet action. Pinions are heat-treated chrome-moly steel.

**SHAFTS** are precision machined and ground. **ANTI-FRICTION BEARINGS** withstand heavy loads.

**AUTOMATIC SPLASH LUBRICATION** system reliably supplies oil to all moving parts. **MAGNETIC DRAIN PLUG** removes ferrous particles from lubricant.

**BUILT-IN POSITIVE BACK-STOP** is available on all units.

**LINK-BELT GEARMOTORS** are designed to meet the most demanding operating conditions. And they're stocked in various horsepower and ratios for immediate shipment from your nearest Link-Belt factory branch store. For details, contact your representative.

FOR MORE FACTS  
ON GEARMOTORS  
WRITE FOR BOOK 2247



**LINK-BELT**  
THE TRADITION OF QUALITY  
LINK-BELT  
**ENCLOSED DRIVES**

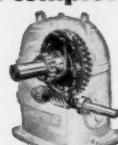
LINK-BELT LIMITED: Scarborough Plant, General Offices and District Sales—Scarborough, Ont., Station H, Toronto 13 • Eastern Avenue Plant and Factory Branch Store—Toronto 8 • Sales Offices and Factory Branch Stores—Montreal 15 • Vancouver 12 • Winnipeg 10 • Swastika, Ont. • Halifax: Austen Bros. Ltd. • District Sales Offices—Hamilton • Sydney: Austen Bros. Ltd. • Foundry at Elmsford, Ont. 14,008

Get **JOB-MATED** drive combinations from the complete Link-Belt line

In addition to all three types of enclosed gear drives, Link-Belt builds variable speed drives, fluid drives, chains, sprockets, couplings, bearings, shafting, etc. All are pre-engineered for easy installation and maximum efficiency.



Parallel Shaft  
Gear Drives  
— ask for Book 2619



Worm Gear Drives  
— ask for Book 2324-A



Helical Gear Drives  
— ask for Book 2451

**Now! Get high impact strength plus mouldability**

**for high speed injection moulding**

**all in one great new Dow plastic**

# STYRON 475M

"M" stands for the mouldability now available in high impact STYRON\* 475M. With this new formulation, you can bring more ideas to life . . . make them practical and economical.

STYRON 475M offers lower melt viscosity and permits freer flow of material into complicated, large area moulds. It makes thinner wall sections practical. Its easy mouldability means faster moulding

cycles and increased production for a whole new range of Canadian products.

STYRON 475M adds the advantages of mouldability to the qualities that have made STYRON 475 Canada's favourite high impact polystyrene.

For further information contact our nearest sales office or write direct to: DOW CHEMICAL OF CANADA, LIMITED, 600 University Ave., Toronto 2, Ontario.

#### PERFORMANCE-PROVED FAMILY OF DOW PLASTICS

|          |                       |         |      |                                   |
|----------|-----------------------|---------|------|-----------------------------------|
| ETHOCEL* | EXCEPTIONAL TOUGHNESS | STYRON* | 475M | EASY FLOW — HIGH IMPACT           |
| STYRON*  | 666                   |         | 777  | MEDIUM IMPACT                     |
|          | 688                   |         | 440  | HIGH HEAT — HIGH IMPACT           |
|          | 689                   |         | 480  | EXTRA HIGH IMPACT                 |
|          | 475                   |         | 700  | HIGHEST HEAT RESISTANCE           |
|          | TYRIL*                |         |      | GOOD IMPACT — CHEMICAL RESISTANCE |

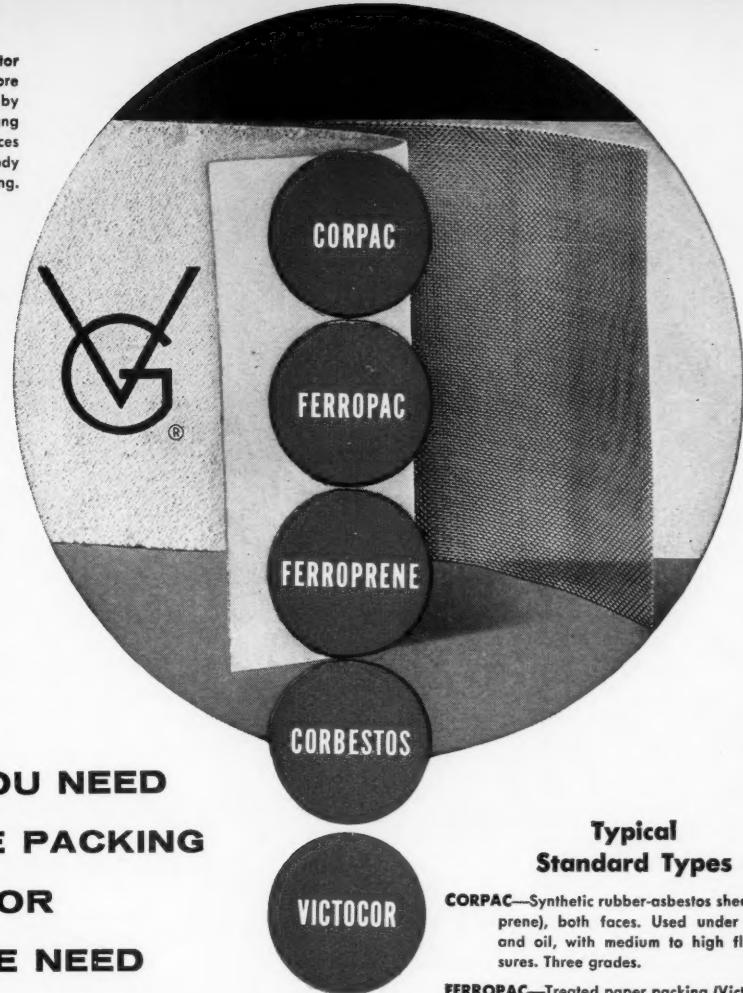
\*Trademark of Dow Chemical of Canada, Limited

*Plastics Basic to Canadian Living*



DOW CHEMICAL OF CANADA, LIMITED • CALGARY • MONTREAL • SARNIA • TORONTO • WINNIPEG

**LOCKED-FOR-LIFE** Victor construction. Packing and core are permanently bonded by means of formed tang projections on both faces of core, clinched into body of packing.



**WHERE YOU NEED  
STEEL CORE PACKING  
VICTOR  
FILLS THE NEED**

Where you're sealing under heavy loading, pounding or temperature, steel core packing is the modern specification. Its greater benefits and values are firmly established.

Actually it's the core that maintains a tight seal under tough conditions. It holds the packing in place, prevents shifting and extrusion. It resists torque loss on flattening because its effect on packing compressibility is nil.

From the widest range of highly engineered, SAE-ASTM rated packings, Victor literally can "tailor-make" steel core gaskets to your most precise specifications. Where needed, Victor successfully modifies the characteristics of standard types with virtually unlimited combinations and structures.

Get unbiased recommendations with complete technical and application data from your Victor Field Engineer. Or contact the factory directly. Victor Mfg. & Gasket Co., of Canada Ltd., St. Thomas, Ont. In U. S.: Victor Mfg., & Gasket Co., Chicago 90.

**Typical  
Standard Types**

**CORPAC**—Synthetic rubber-asbestos sheet (Asbestoprene), both faces. Used under high heat and oil, with medium to high flange pressures. Three grades.

**FERROPAC**—Treated paper packing (Victorite), both faces. For service against gasoline, oil, grease, water, under medium flange pressures. Holds up under frequent dismantling.

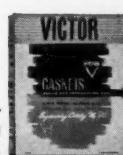
**FERROPRENE**—Compressed asbestos sheet packing (Victopac) one side, compounded synthetic rubber (Victoprene) on other. Useful under high heat and oil; low to medium flange pressures.

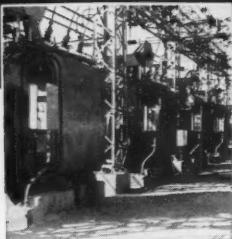
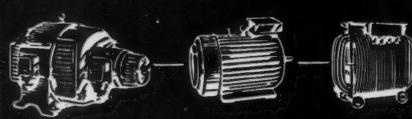
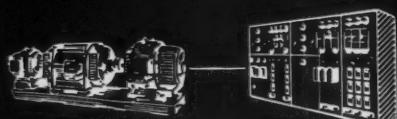
**CORBESTOS**—General-purpose, beater-treated asbestos sheet packing for use on oil, gasoline, water, steam, antifreeze. Adaptable to all temperature and bolting pressure needs. Six standard structures including double-sided, single-sided, steel-faced and laminated.

**VICTOCOR**—Compressed asbestos sheet packing, both faces. Low torque loss. High heat and crush resistance. For high flange pressures on hot oils, gasoline, water, antifreeze.

**VICTOR**  
Sealing Products Exclusively

**GASKETS • PACKINGS • OIL SEALS • MECHANICAL SEALS**





## **With 'Transformers' too — accuracy plays an important part**

Billiards is the most mechanistic of games. Given the elasticity and weight of the balls, the resilience of the cushion, the rolling friction of the cloth, it must be possible to calculate exactly where and how hard to strike the cue ball. But you never see a billiard player doing sums. Somehow his knowledge is instinctive. The result of much experience.

Similarly it ought to be possible to specify a product such as a transformer. Perhaps it is. But in practice, as everyone knows, it doesn't work like that. For manufacture involves hundred of decisions that are made on experience. Like the expert billiard player, a Company with years at the job is able to sum up rapidly and almost unconsciously the combined effect of a large number of variables; it has, in fact something analogous to his 'skill' which comes out in the quality of its products. That's why the name on a product can mean so much.

FOR THE FINEST IN QUALITY AND PERFORMANCE CONSULT . . .

# **BEPCO CANADA LIMITED**

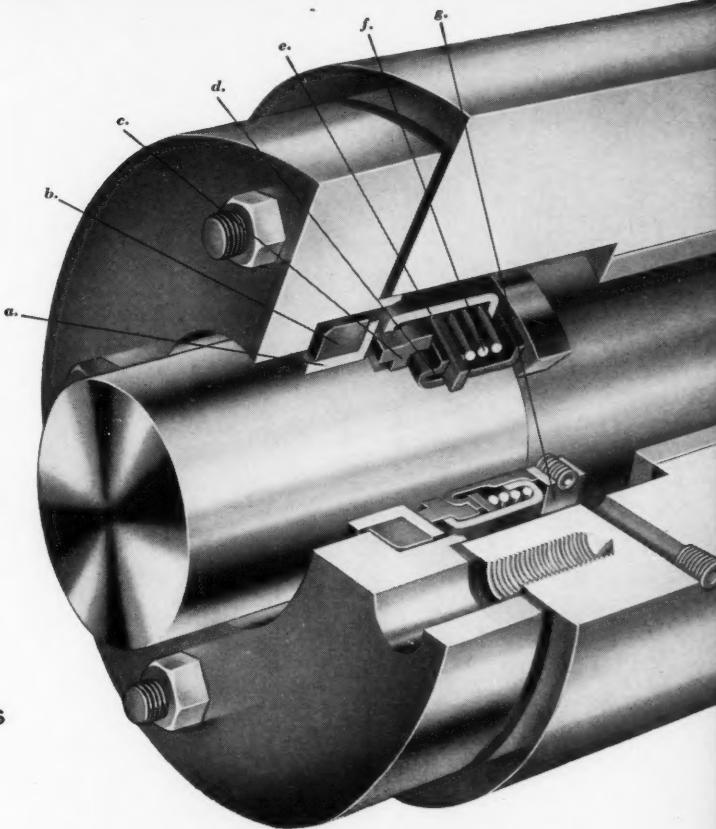
MONTREAL • QUEBEC • OTTAWA • TORONTO • HAMILTON • WINNIPEG • VANCOUVER

MORE OF THE GARLOCK 2,000

# No More Stuffing Box Maintenance!

*Install  
Garlock  
Package Seals  
on Your  
Present Pumps*

- ELIMINATE LEAKAGE AND SHAFT WEAR
- REDUCE DOWNTIME
- CUT MAINTENANCE COSTS



When leakage and maintenance are serious problems in the operation of your pumps you'll find a perfect answer in Garlock MECHANIPAK\* Seals. Installation on new or existing equipment is simple. And, several designs are available to meet a variety of operating conditions: pressures to 150 psi, temperatures to 212° F., and shaft speeds to 2000 feet per minute. Sizes for shafts from  $\frac{3}{8}$ " to 3" diameter for sealing against water, oils, alcohol, mild acids and solvents.

MECHANIPAK Seals are another important part of "the Garlock 2,000" ... two thousand different styles of packings, gaskets and seals for every need. It's the only complete line ... that's why you get unbiased recommendations from your Garlock representative. Ask him for complete data on this long-life, maintenance-free MECHANIPAK Seal. Or write for Folder AD-150.

THE GARLOCK PACKING COMPANY  
OF CANADA LTD.

General Offices: Toronto, Ont.  
Branch Offices: Hamilton, Montreal, Winnipeg, Edmonton, Vancouver

a. Stationary Seat of ceramic, Ni Resist, or bronze has precision lapped sealing face for perfect contact with carbon ring.

b. Vibration Ring of Buna-N positions stationary seat in a flexible mounting and acts as static seal.

c. Seal Ring of carbon is also precisely lapped to match sealing face of stationary seal.

d. Roll type Bellows permits free movement of seal ring.

e. Shell, encases entire rotary unit and furnishes mechanical drive for seal ring.

f. Stainless Steel Spring with load precisely calculated to face area of seal.

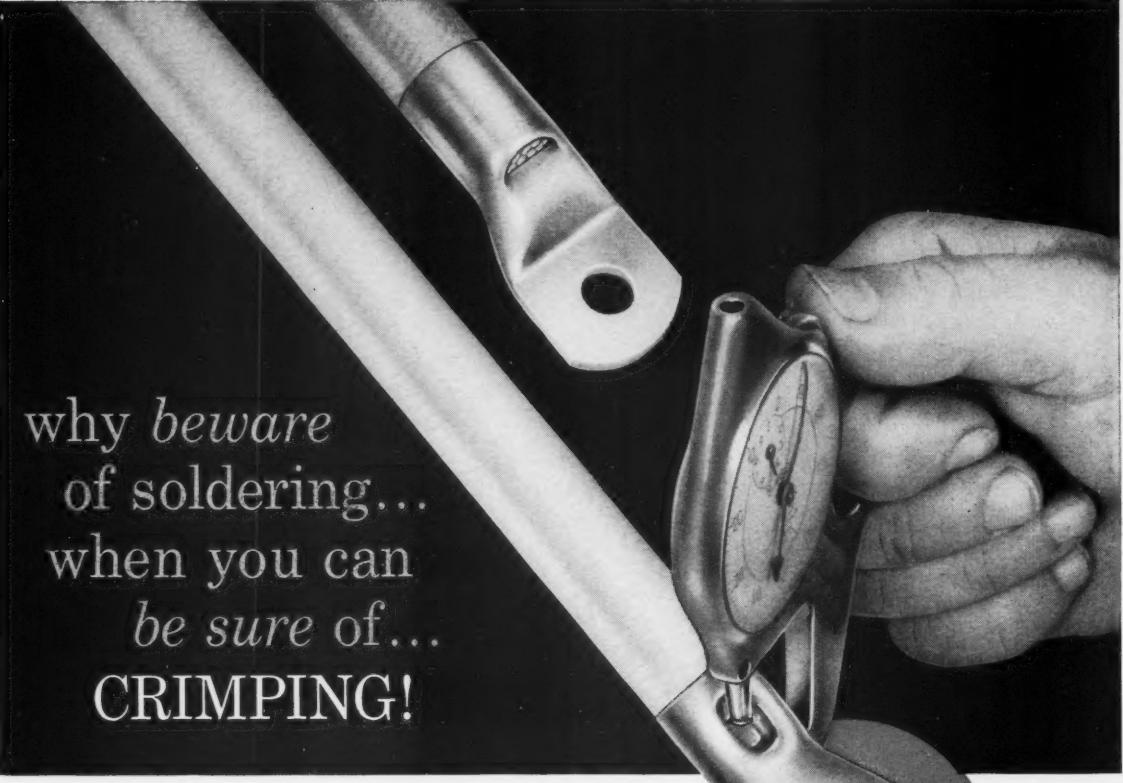
g. Stop Collar, or shoulder, positions seal to specified operating length.

# GARLOCK



Packings, Gaskets, Oil Seals, Mechanical Seals,  
Rubber Expansion Joints, Fluorocarbon Products

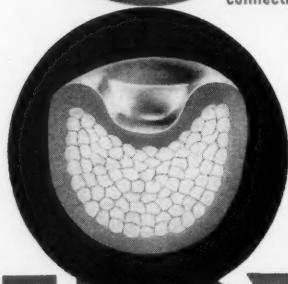
\*Registered Trade Mark



why *beware*  
of soldering...  
when you can  
*be sure of...*  
**CRIMPING!**

*a quick check of indent-depth tells you  
this electrical connection is safe!*

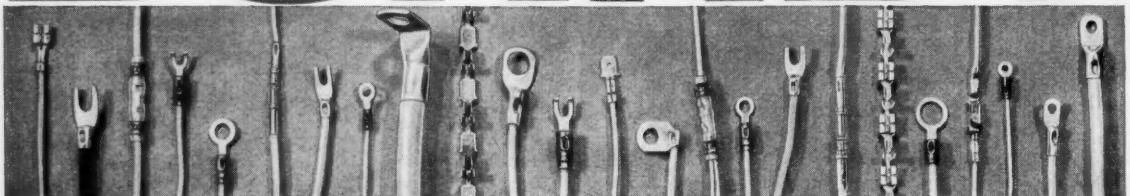
There's no way to check a soldered connection—without destroying that connection! The modern Burndy crimping method affords a quick check for electrical and mechanical safety—simply by measurement of this depth of indent. The cross-section view (right) shows how this indent is designed to coin conductor and connector into intimate contact...for a strong connection, as electrically sound as the conductor itself. And the depth of indent is controlled by the installation tool! Unlike solder which can weaken at high temperatures frequently encountered by modern equipment, the Burndy crimped connection with its wide tolerance endures in all environments. Too—Burndy electrical connections get rid of human error—no skill or training is required. The control is engineered into the connector and the tool! Put a crimp on rising production costs!—send for the full story on Burndy crimp-type connections, today!



first piece check  
guarantees electrical  
connections for the entire  
production run

# BURNDY

5803

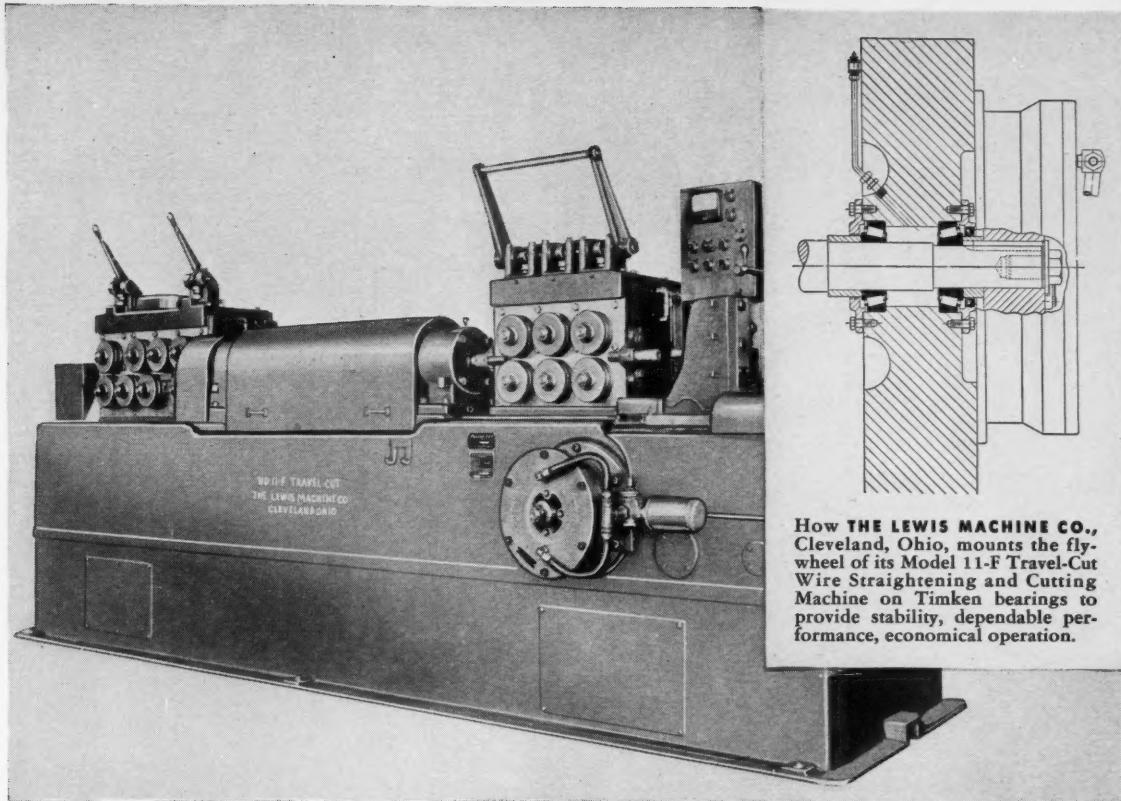


**BURNDY CANADA LIMITED**  
1530 BIRCHMOUNT ROAD, SCARBORO, ONTARIO

OFFICES IN

MONTREAL  
WINNIPEG

CALGARY  
VANCOUVER



How THE LEWIS MACHINE CO., Cleveland, Ohio, mounts the flywheel of its Model 11-F Travel-Cut Wire Straightening and Cutting Machine on Timken bearings to provide stability, dependable performance, economical operation.

## How TIMKEN bearings keep flywheel stable on automatic wire straightening and cutting machine

**T**O take the varying loads of automatic wire straightening and cutting, the bearings in this Lewis Model 11-F Travel-Cut have to be extra tough and virtually friction-free. That's why The Lewis Machine Company uses Timken tapered roller bearings for the flywheel, feed rolls and drive—38 in all. Timken bearings keep the flywheel stable and rotating freely, position gears and feed rolls accurately even under heavy loads.

**EXTRA LOAD-CARRYING CAPACITY.** Full line contact between their roll-

ers and races gives Timken bearings extra load-carrying capacity. Tapered design lets Timken bearings take both radial and thrust loads in any combination. The flywheel doesn't wobble. Gears and feed rolls stay in position.

**PRACTICALLY FRICTION - FREE PERFORMANCE.** Because they're geometrically designed to roll true, and precision-made to live up to their design, Timken bearings virtually eliminate friction. They run smoother, last longer.

**NO SHOCK PROBLEMS.** Because they're case-carburized, Timken bearings' rollers and races have a hard, wear-resistant surface over a tough, shock-resistant core. They absorb shocks, reduce maintenance.

That's why it pays to specify bearings trade-marked "TIMKEN". The Timken Roller Bearing Company, Canton 6, Ohio, U. S. A. CANADIAN PLANT: St. Thomas, Ontario. Cable address: "TIMROSCO".

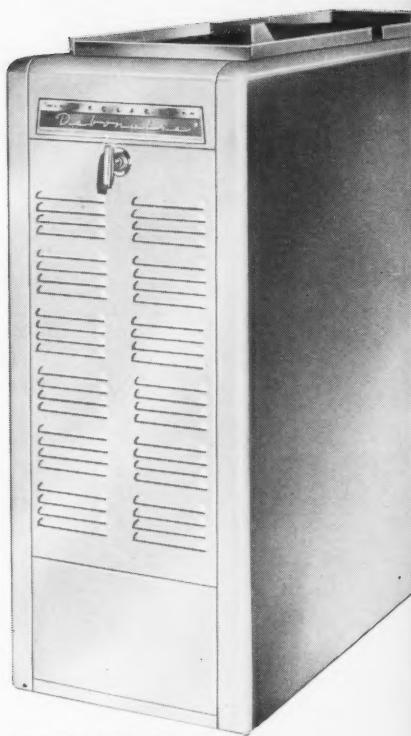


This symbol on a product means  
its bearings are the best.



NOT JUST A BALL ◻ NOT JUST A ROLLER ◻ THE TIMKEN TAPERED ROLLER ◻ BEARING TAKES RADIAL ◻ AND THRUST ◻ LOADS OR ANY COMBINATION ◻

another CPI product through research



12G Series McClary Debonaire  
Gas-fired Winter Air-Conditioner

The beautiful, top-quality finish on this outstanding McClary Winter Air-Conditioner is another successful result of Canadian Pittsburgh research at work. By scientifically studying this finish problem, our experts developed for General Steel Wares a Hammertex finish that applied easily, went further, provided lower finishing costs.

Another example of what Canadian Pittsburgh's research team has done—and can do for you!

GLASS-PAINT PITTCO METAL  
**CANADIAN**  **PITTSBURGH**  
INDUSTRIES LIMITED

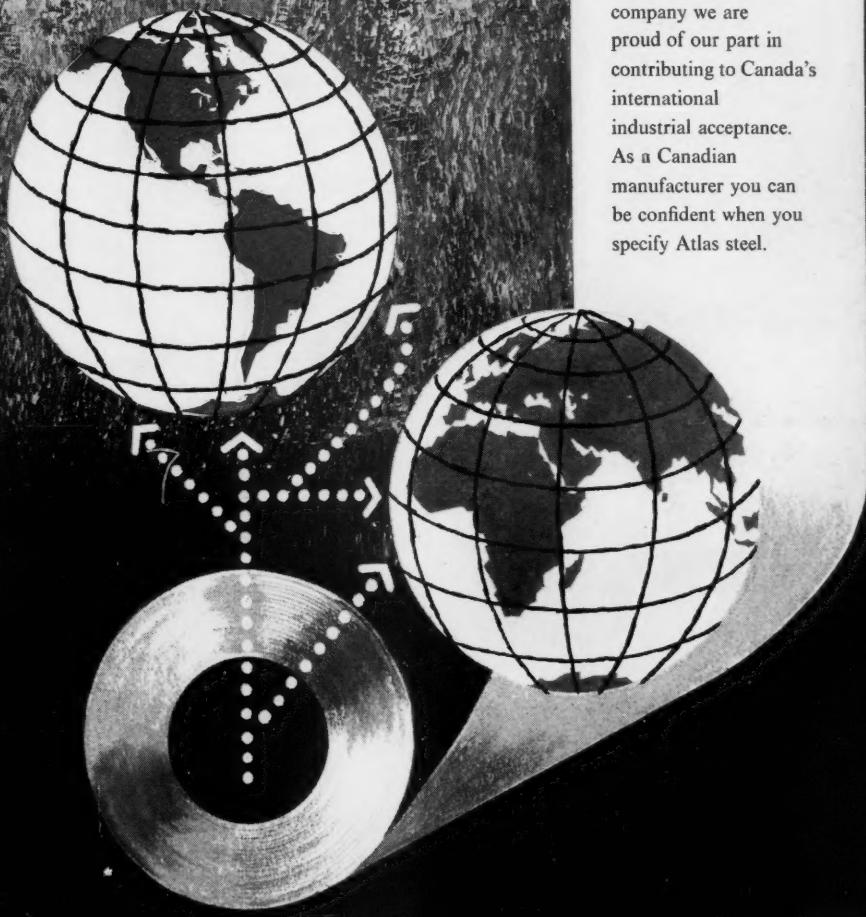
6223

This finish  
started  
with  
research



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Atlas as a standard of  
quality in specialty steel  
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the world over are proof  
of this. As a Canadian  
company we are  
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STEELS**



*A controlled experiment in the development of new synthetic resins at the Glidden Laboratory.*



## **HOW GLIDDEN CREATIVE RESEARCH CAN HELP YOU WITH YOUR FINISHING PROBLEMS.**

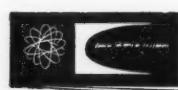
From golf-clubs to freight cars, we provide finishes for thousands of different products made by a great many manufacturers from coast to coast.

In case after case Glidden Research has played an important part in developing a better product finish. In many cases developing completely new finishes which have added to the value of the product, have cut costs, increased production efficiency, and product "life".

This practical experience of truly creative research work—testing and re-testing, repeatedly experimenting with new and better finishes—places our chemists in a unique position to assist you! They have the knowledge and the skill. At the Glidden Laboratory they have the most modern research facilities with which to work.

In addition, our Technical Service Department employs the same creative approach to solving your on-the-job problems—working, where necessary, right with you in your plant.

These research services are yours for the asking. So why not let us put our know-how and creative insight to work to assist you. For further information, please contact our service representative or write direct to us at the address below.



### **INFORMATION YOU'LL VALUE!**

This booklet outlines all Glidden Technical and Laboratory Services—and how you can profit by them. We will gladly send a free copy to plant executives on request. Just write to:

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are another reason for the big extras in forgings  
Dominion delivers at no extra cost to you

Multiple equipment is the forging user's best guarantee of "on time" delivery and quality forgings at a consistent price. You can count on all three when your supplier is Dominion Forge, one of North America's great forges.

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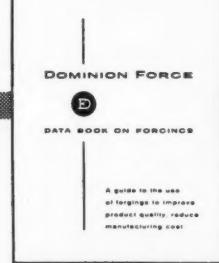
Whatever you require in forgings—from 15 to 150,000 of one design, in sizes from an ounce to over 300 pounds—your Dominion Forge *forging engineer* is trained to help you get *all* the extras in forgings. You're invited to call on his experience.

## DOMINION FORGE LIMITED



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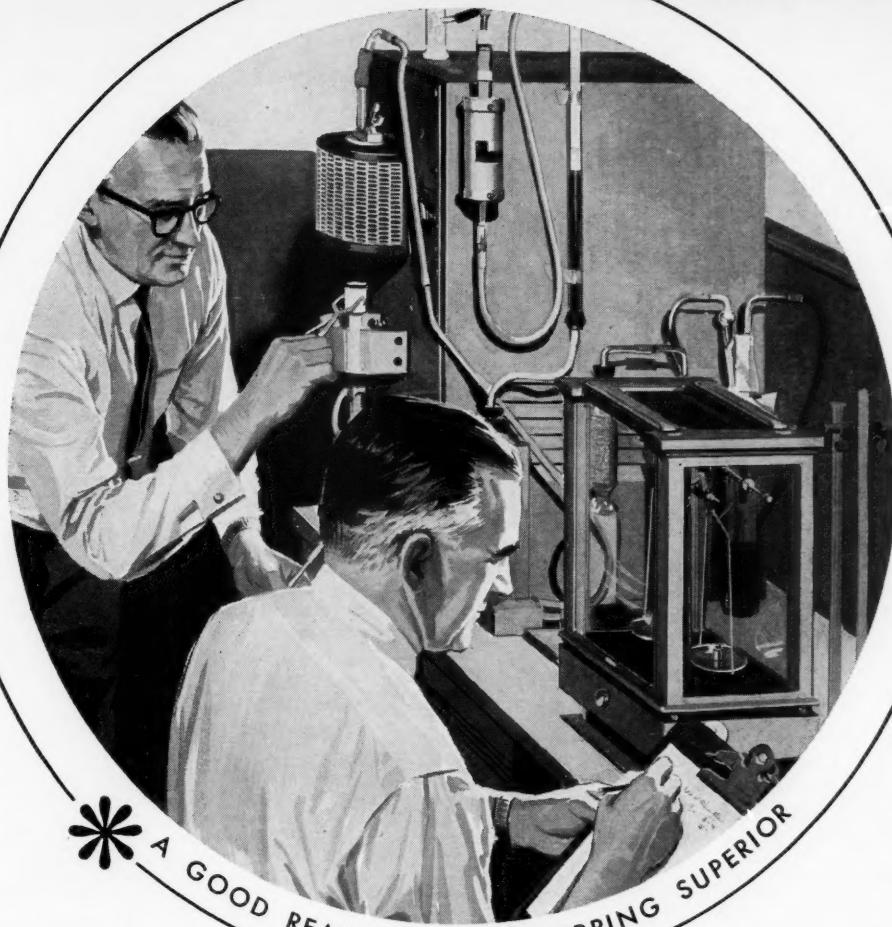


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**BOARD HAMMER OPERATOR** Danny Romano and over 125 other members of Dominion's Quarter Century Club are representative of the forging experience available to you.

*Tubexperience in action*



A GOOD REASON FOR PREFERRING SUPERIOR

## How does carbon content control hydraulic tubing quality?

### Precise metallurgical controls help Superior's (SAE) Hydraulic Tubing outperform all other types

\*Extra quality is the reason for the high ductility and longer, more reliable service you get with Superior hydraulic tubing. This extra quality is actually built in through precise metallurgical control.

Carbon content is held to .12% maximum through controlled atmosphere annealing. This assures highest ductility commensurate with the strength needed in the tubing.

Superior (SAE) Hydraulic Tubing is made from selected billets of non-aging steel. These are segregated by heat numbers, and a customer's order is always filled from one heat. This assures complete uniformity of all the tubing shipped to him in that order.

Each order also undergoes many critical examinations. Among these are checks on elongation, yield and ultimate strength. Every length is also 100% hydrostatically tested to maximum working pressure. And close control is exercised over grain size and microstructure. This is done microscopically with the aid of metallographic mounts. And finally, if requested, we furnish a notarized report on the chemical and physical properties of the tubing produced.

Superior (SAE) Hydraulic Tubing is furnished in dead-soft annealed temper for easy bending and flaring. Order in cut, multiple or random straight lengths up to 30 ft.—or longer in coiled form.

For more data on our (SAE) hydraulic tubing, get a free copy of Bulle in 39. Write Superior Tube Company, 2052 Germantown Ave., Norristown, Pa.

LYMAN TUBE & BEARING, LTD., Montreal, Toronto & Winnipeg

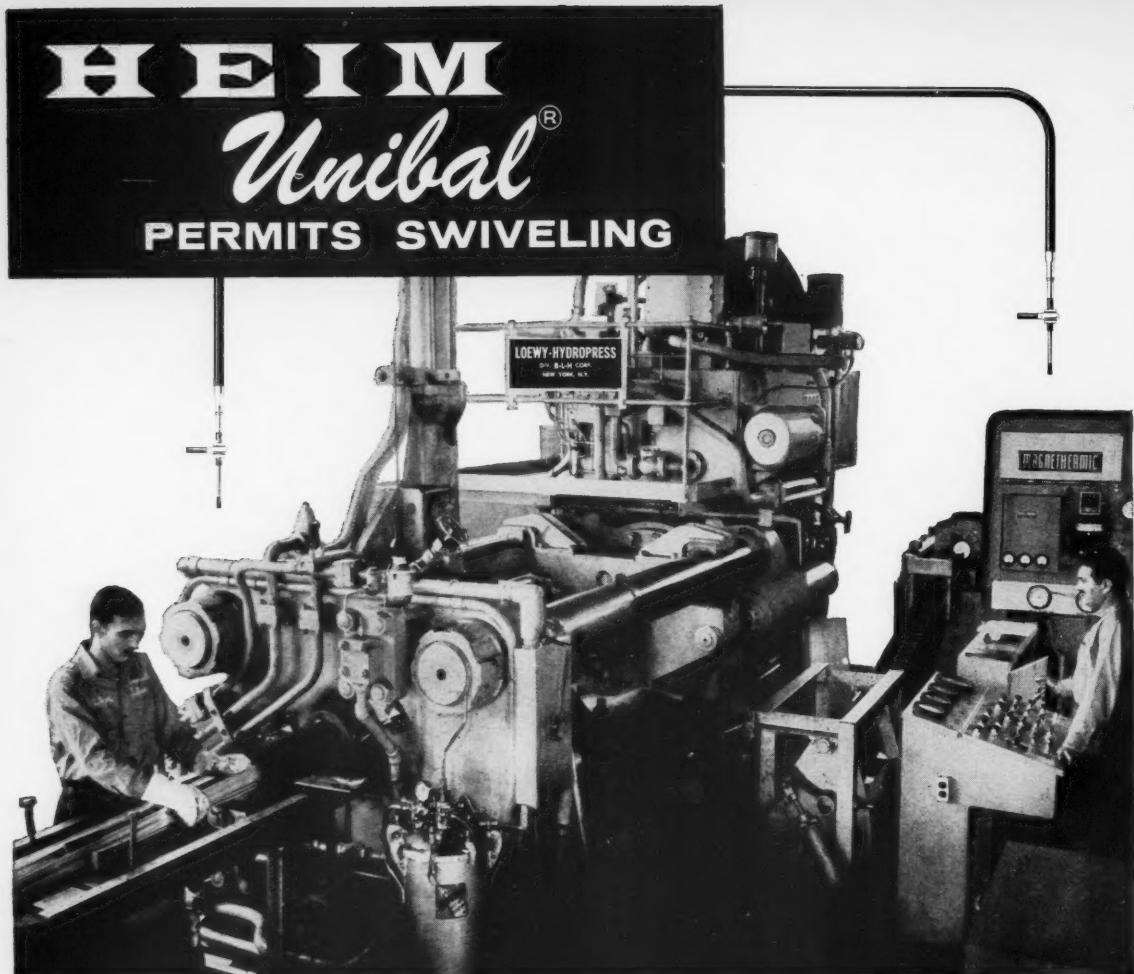
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**Superior Tube**

The big name in small tubing

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All analyses .010 in. to  $\frac{5}{8}$  in. OD—certain analyses in light walls up to  $2\frac{1}{2}$  in. OD



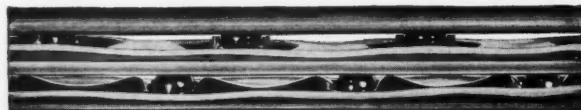
From the pulpit directly to this 1250-ton extrusion press is an ingenious, mechanical, remote push-pull control to which this giant responds. It consists of a solid, flexible stainless steel blade, 24 feet long, moving between rows of stainless steel balls and housed in a flexible tubing. It is called Controlex and is made by Controlex Corp., White Plains, N.Y.

A manually operated lever at the control board, or pulpit, moves the blade in the desired direction, and in order to permit swiveling and for the relief of eccentric thrust on the push-pull end rod, a



### HEIM *Unibal*® SPHERICAL BEARING ROD END is used at the mounting point.

Another Unibal Rod End bearing, mounted at the machine end of the control, completes the swiveling or misaligning action as required.



Controlex makes controls over 100 feet long — a linear ball bearing with 42 balls to the foot.

Press for extruding aluminum strip, built by Loewy-Hydropress Division of Baldwin-Lima-Hamilton Corp.

This application of the Heim Unibal demonstrates one way in which it serves as a mounting device through which the Controlex end fitting passes. Does it give you any ideas for use on *your* equipment? There seems to be an unending list of possible applications for the Heim Unibal, and our engineering department is ready to help you work out details.

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In addition to 15 Davenport Automatics pictured above, we have a large battery of screw machines, single and multiple spindle, with machining capacity from 1/32" through to 2 5/8" diameter material. Also automatic chucking machine to 8" capacity.



# **WEATHERHEAD** SCREW MACHINE DIVISION

HERE ARE A FEW OF THOUSANDS OF PARTS  
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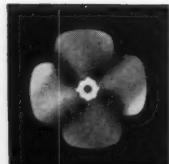
No matter which way the wind blows with your blower unit requirements—belt-driven, direct drive or radial-axial mixed flow—Torrington has the solution to your problems.

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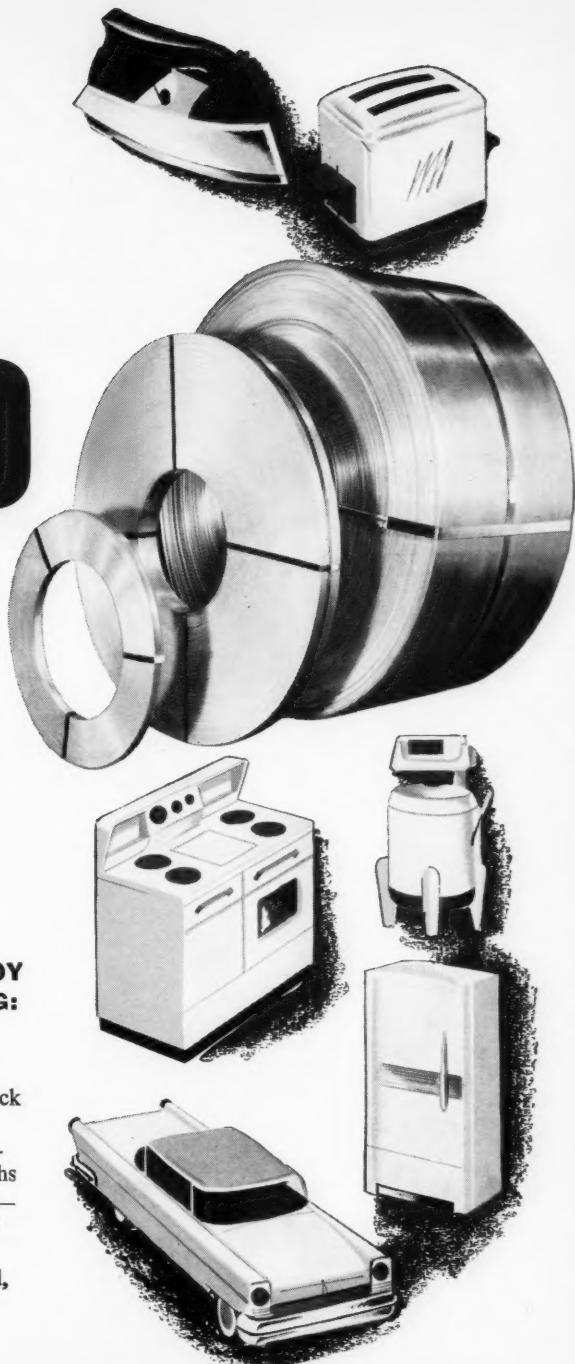
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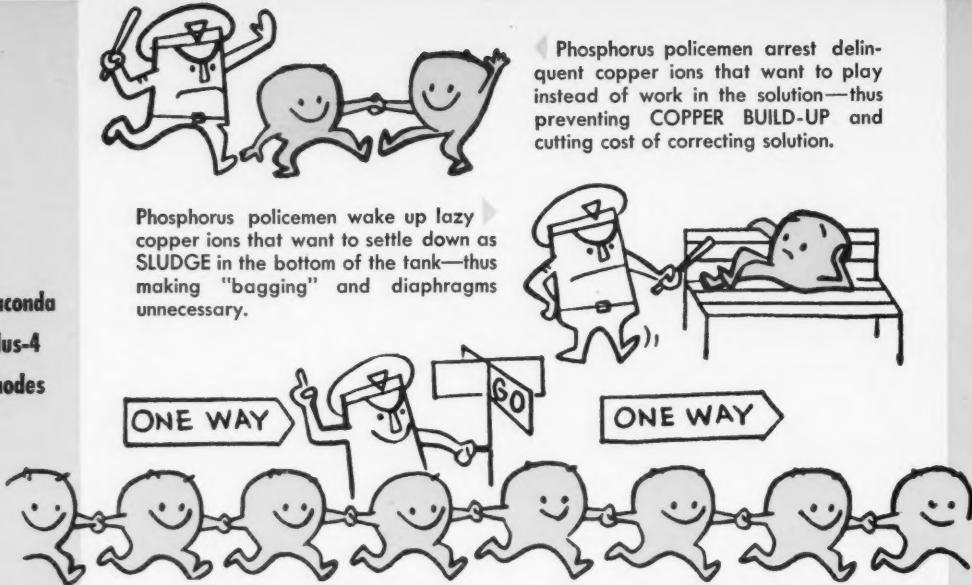
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Plus-4  
Anodes

Your  
Work



Phosphorus traffic police keep copper moving uniformly to give you SMOOTH, HEAVY CATHODE DEPOSIT—up to 15% more cathode deposit per anode—and UNIFORM ANODE CORROSION leaving small "fish" that cut scrap losses.

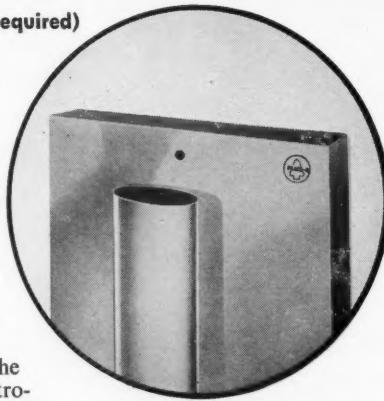
# **PLATING COSTS LESS WITH ANACONDA "PLUS-4" ANODES**

- + 1 no anode sludge (no "bagging" or diaphragms required)
- + 2 no copper "build-up" in solution
- + 3 smooth, heavy cathode deposits
- + 4 up to 15% more cathode deposit per anode

The playful characters above give perhaps an oversimplified explanation of a laboratory development now saving acid-copper electroplaters, electrotypers and electroformers a lot of time and money.

Metallurgists have found that if copper used as anodes contains a small but precisely controlled percentage of phosphorus, all the copper moves uniformly through the acid-copper solution to the object being plated. The phosphorus seems to act like a policeman.

Anaconda "Plus-4" Phosphorized Copper Anodes are the result. They have been proving their superiority in acid electro-plating tanks in many parts of Canada. Write for publication C-5. Anaconda American Brass Limited, New Toronto, Toronto 14, Ont. C-1722

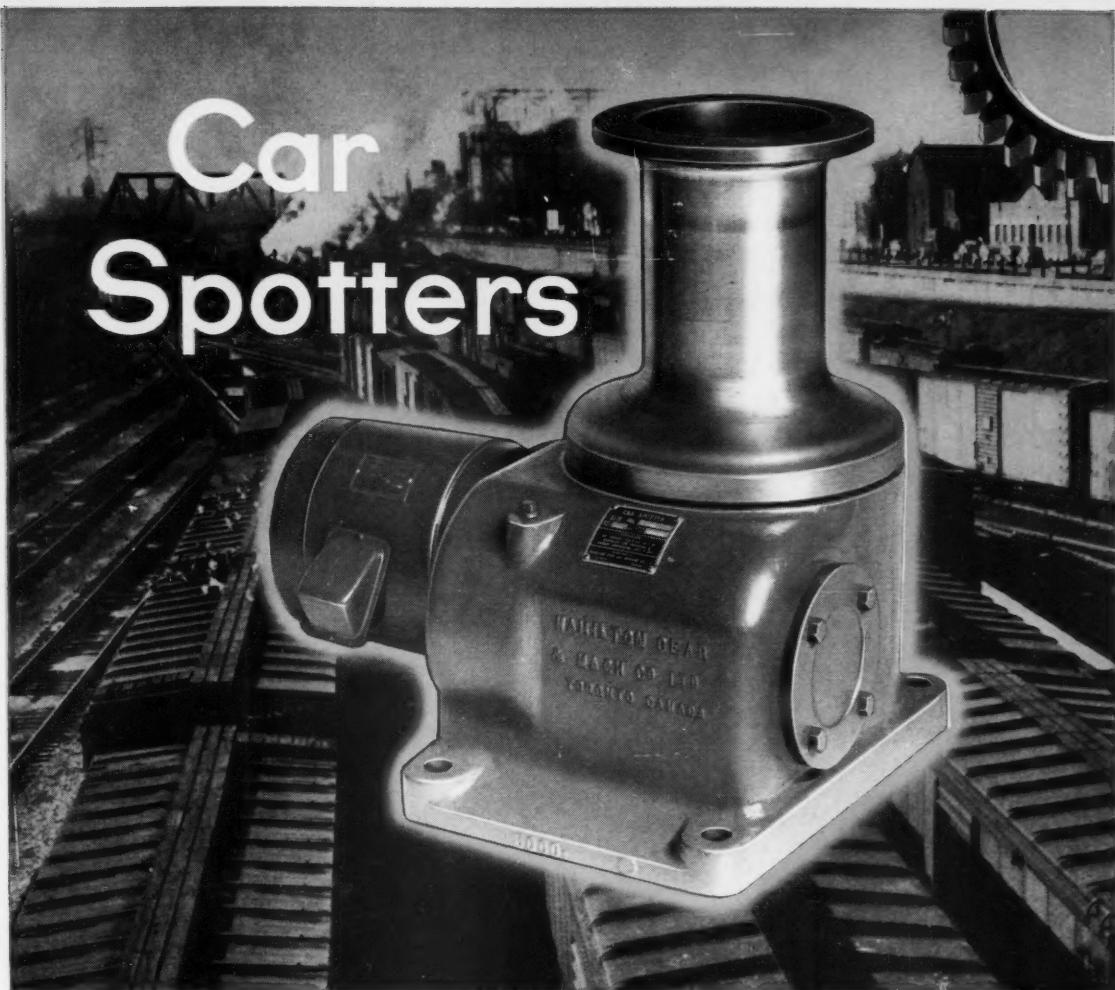


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ANACONDA AMERICAN BRASS LIMITED

## New Toronto, Ontario.

*Sales Offices: Montreal and Vancouver*



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Hamilton Gear carspotters are of compact, rugged, enclosed design suitable for either indoor or outdoor operation. Housing and capstan are of high strength cast iron. Capstan is machined on the rope bearing face for maximum rope life. Speed reduction between motor and capstan is by forged steel helical gears and hardened and ground worm and bronze wormgear. These are of the same high quality as used in Hamilton Gear standard reduction units. All shafts, including capstan, are mounted on ball or roller bearings. Available in 3000, 5000, and 10,000 lb. rope pull capacity. Send for Bulletin.



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Worms and  
Wormgears

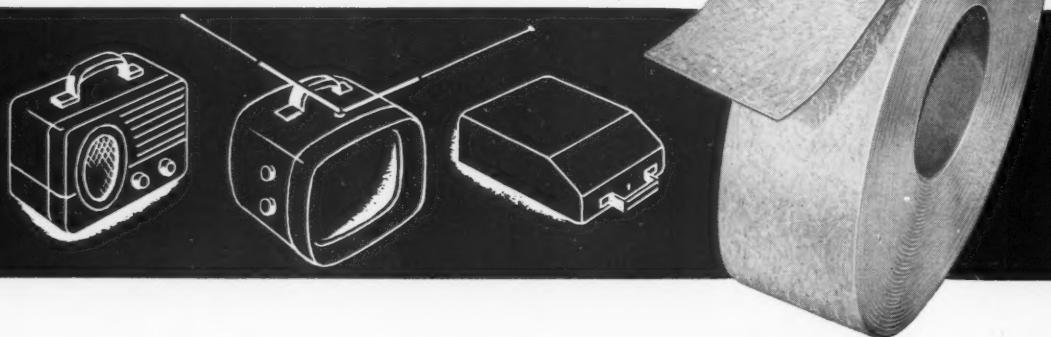


Internal  
Gears



Wormgear  
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**I**ntroducing vinyl coated  
metal in coils... unsurpassed  
for strength and beauty



**Hunter**  **Douglas**  
**KLADKOIL**

**MADE IN CANADA**

The Research Department of Hunter Douglas Ltd., has perfected a method of applying vinyl to metals in a continuous process so that a quality vinyl coated coil is produced at a moderate cost.

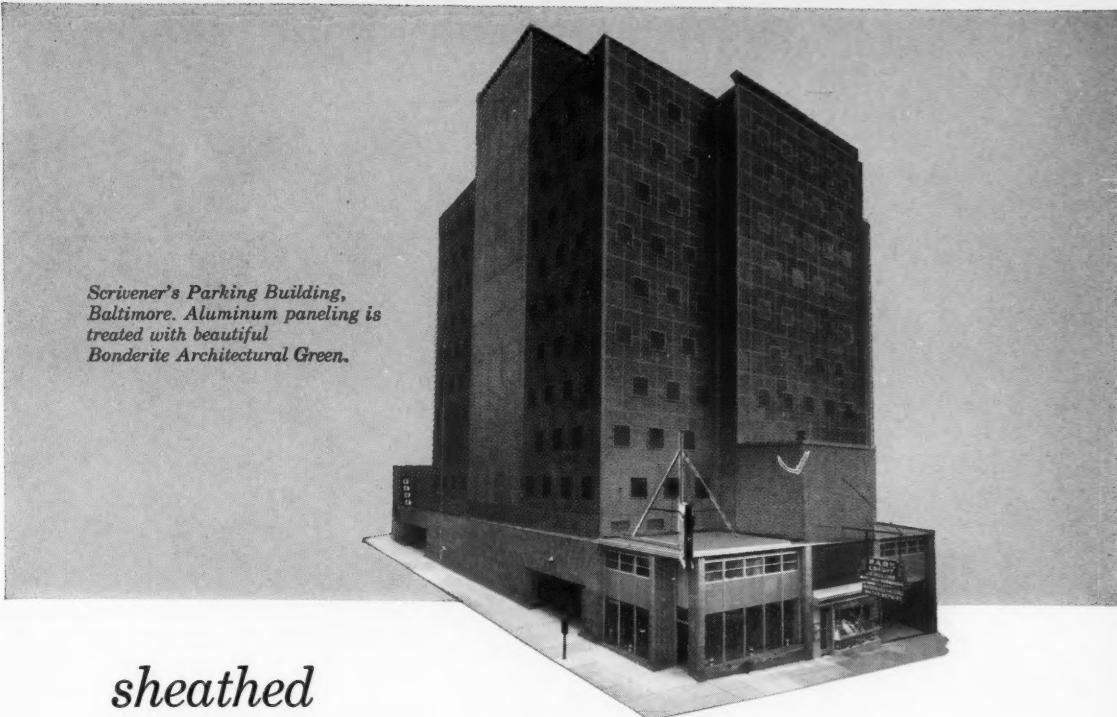
KladKoil combines the warm feel, color and texture of vinyl with the strength of steel. The coating may be plain or embossed in a variety of patterns including leather grain.

KladKoil may be rolled, drawn, shaped or formed into practically any shape. The coating is so flexible that the metal will break before the vinyl does.

KladKoil is the ideal material for automobile trim and dashboards, office equipment and household appliances, novelties, partitions and mouldings and many other fields where strength and beauty are of primary importance.

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*Scrivener's Parking Building,  
Baltimore. Aluminum paneling is  
treated with beautiful  
Bonderite Architectural Green.*

*sheathed  
in aluminum . . . and protected by*

## **Bonderite Architectural Green**

You'll see many more buildings, like this attractive structure in Baltimore, using aluminum finished with Bonderite Architectural Green. There are so many things to recommend this beautiful, durable Bonderite coating!

Treatment with Bonderite Architectural Green protects aluminum from corrosion. The same protective treatment chemically produces a soft, lasting green color which is a part of the integral coating of the metal surface. Color is sun-and-weather-fast.

Bonderite Architectural Green costs far less than electrolytically produced color coatings for aluminum. It is simple to use, and the color uniformity is a sure visual

check on the uniform quality of the coating, maintained in volume production day in and day out.

Bonderite Architectural Green may be applied by spray or immersion, and by continuous strip treatment.

Metal treated in this manner can be used not only in construction panels, but also for siding, awnings, venetian blinds and many items on which the excellent color and durability contribute to a better, more salable product.

*Write for descriptive illustrated booklet "Bonderite 700 Series". Details on Bonderite Architectural Green, uses, advantages, characteristics.*



# PARKER RUST PROOF COMPANY

OF CANADA, LTD.  
Rexdale Blvd., Rexdale (Toronto) Ontario

BONDERITE  
corrosion resistant  
paint base

BONDERITE and BONDERLUBE  
aids in cold forming  
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PARCO COMPOUND  
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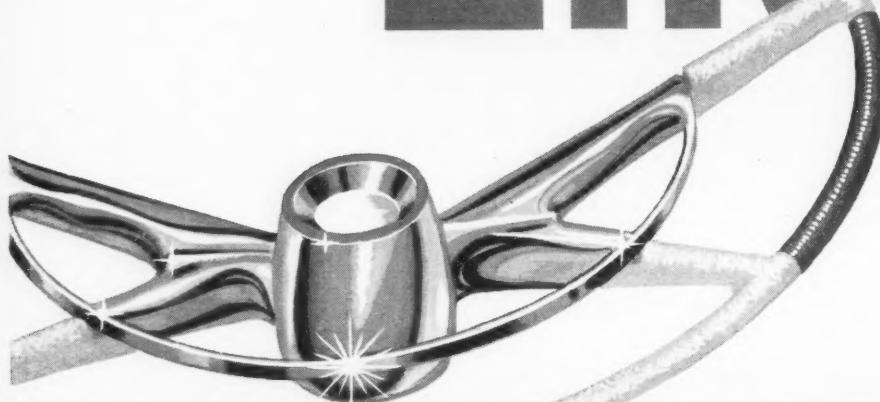
PARCO LUBRITE  
wear resistant for friction  
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TROPICAL  
heavy duty maintenance  
paints since 1883

\*Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

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# ZINC



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Following the curve of the steering wheel just inches away from the driver's hand, the horn ring on a modern automobile stands ready to sound a warning to pedestrians and other vehicles. It's strong, attractive and durable—die cast in Zinc!

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If you require information or assistance regarding your Zinc die casting operations, contact our Technical Service Staff. Your inquiries will receive prompt attention.

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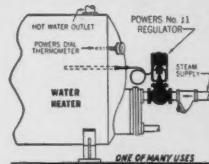
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A Versatile Control for hundreds of applications. Has big 4" easy to read dial thermometer. Gives visual proof of constant temperature control. Helps to accurately adjust the regulator. A feature originated by Powers in 1930.

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**TEMPERATURE CONTROL**  
made for: Many Industrial Processes, Heat Exchangers, Air Compressors, Diesel Engines, Fuel and Crude Oil Heaters and Treaters.



**SELF OPERATING**

## WHY POWERS No. 11 REGULATORS Give BETTER CONTROL and Last Longer

### Check these QUALITY Features —

**Bellows** has 50% more power than used in majority of other regulators. Its durable 2 ply construction outlasts ordinary single ply types.

**Powers New 590 LONG-LIFE Valve Packing** marks an important milestone in the reduction of maintenance and prevention of leakage. It has an extremely low friction factor and outlasts others by a big margin.

**60° F. temperature ranges.** Control system is sensitive to temperature changes within 1 to 2° F.



Use Powers 65 years of experience and engineering know-how to help you select the right type temperature regulator and right size valve. From our complete line of self operating regulators and air operated temperature controllers you can be sure of getting the control best suited for your requirements.

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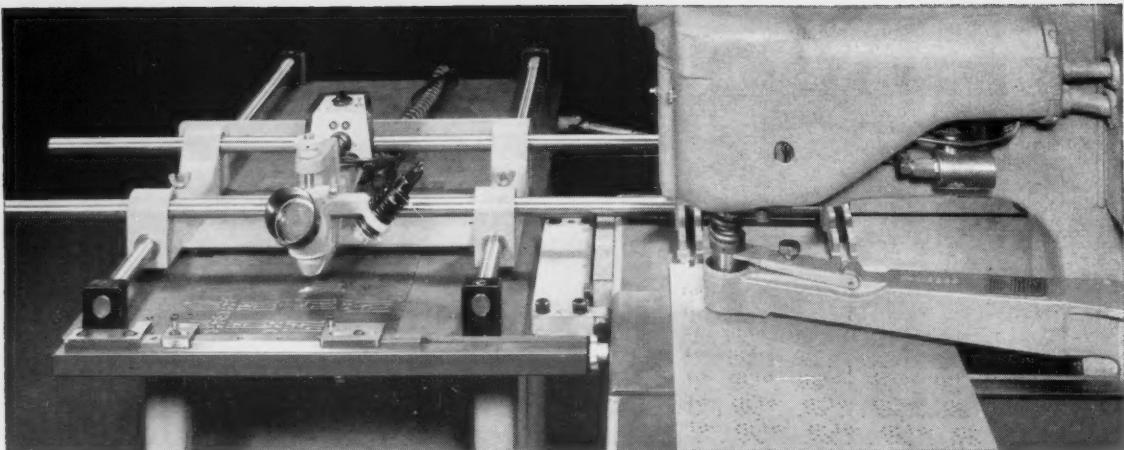


Since 1891

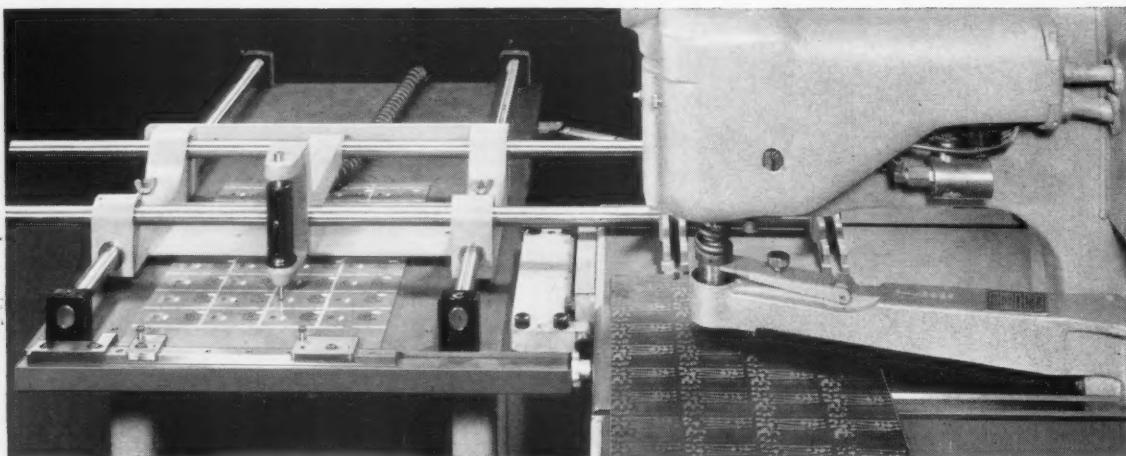
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Above: Flanged Iron Body Valve with Double Seat for sizes above 2"

**THE POWERS REGULATOR COMPANY of CANADA, LTD.**



a faster way to **cold-punch** printed circuits



## The DUPL-O-SCOPE

Firms punching and notching printed circuit boards — or any sheets up to  $\frac{1}{4}$ " mild steel — know how profitable it is with a Strippit Fabricator-Duplicator. Now, it's even faster with the new Dupl-O-Scope, which eliminates the template drilling and layout step!

Readily mounted in the Duplicator stylus bracket, this precision optical pickup device quickly translates a drawing, layout or printed circuit sample into a punched metal template — ready for rapid-fire cold punching and notching on the Fabricator-Duplicator using standard interchangeable tools or "specials" made up to your requirements.

Write today for catalog and an actual demonstration on *your* work at *your* plant by a Strippit Mobile Unit.



**STRIPPIT**  
**TOOL & MACHINE LIMITED**

*Formerly Wales Strippit of Canada, Ltd.*

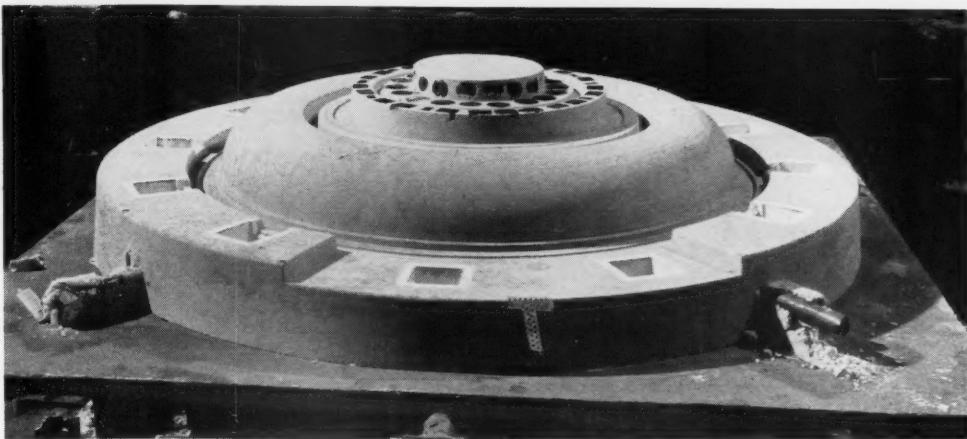
103 Research Rd., P. O. Box 688, Brampton, Ontario



The versatile Strippit Fabricator, one-machine shop for quick-change punching, notching and nibbling — available with positive Duplicator for high-speed production punching and notching in complex patterns including printed circuit boards.

## Design Engineering

DU PONT



Ready in a few minutes, the  $\text{CO}_2$ -cured core can either be stored or moved directly to the pouring line.

# Bakeless hardening of molding sands

## Carbon dioxide passed through the core gels the sand in seconds

The hardening of cores and molding sands by the carbon dioxide process (developed over the past two years) is now established practice in a large number of Canadian foundries.

In order to help Canadian foundrymen who require practical data on some of the everyday problems that arise, Foundry Services (Canada) Ltd., have established with individual foundry customers the types of sand best suited for the process, the special mixes to be used on particular castings, gassing cycles, and the effect of re-using core sands. This information has been compiled as a sectioned and loose-leaf publication to which additional (or revised) pages can be added from time to time, to help engineers keep abreast of the latest developments.

**Type of sand:** Any dry sand, having a minimum clay and other impurity content, can be employed. Washed silica sands with angular or sub-angular grains and with a 3 or 4 screen distribution, and having an AFA fineness of between 50 and 100, usually give the best results.

**The process:** Carbon dioxide ( $\text{CO}_2$ ) gas is passed through a core having a sodium silicate binder, as a result of which the two combine to form a colloidal silica gel around each sand grain, cementing them together within a few seconds.

By using the  $\text{CO}_2$  method, cores are hardened in a matter of seconds without oven baking. This eliminates extra handling, floor space and investment in baking ovens.

No additional equipment is required except for a simple  $\text{CO}_2$  gas manifold system. Supplies would

consist of the sand, a binder and the gas.

Above all, speed and flexibility are now available to both foundry and customer.

### Case history (1).

A production job recently completed by Cooper Alloy Corporation shows how the introduction of  $\text{CO}_2$  to the core shop enabled the demands of the foundry to be met easily, no matter how urgent.

A rush order of 15,000 stainless steel supporting feet for chemical tanks necessitated the use of cores, for without them it was doubtful whether level surfaces could be maintained. The cores were box-shaped with a vertical taper from the top to the (somewhat wider) bottom surface.

After being blown, the cores were passed along to the gassing machine adjacent to the blower where gas was passed through them. An automatic switch cut off the flow of gas at the proper moment and any excess gas escaped through vents in the core plate. The hardened cores were then lifted from the plates and stacked for transfer to the foundry.

This eliminated the baking period (of 4 to 6 hr), the subsequent cleaning and washing, and the entire operation was performed with the use of one cope section, permanently fixed to the blower and four drag sections circulating between blower and gassing machine, so that both could be continuously in use.

To produce such a large rush job in even twice the time by older methods would have been quite impossible. With the  $\text{CO}_2$  process, however, speed and flexibility are achieved while still keeping the highest possible standards of quality.

## Carbon dioxide process continued

### Case history (2).

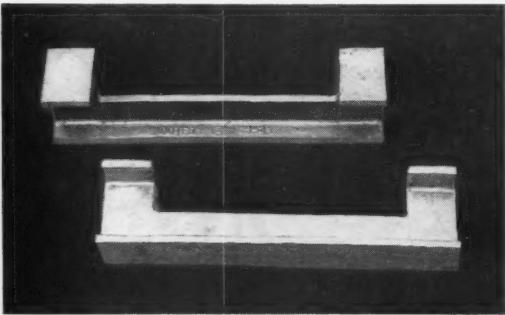
In the production of cores for a run of 4 in. gate valves, Cooper Alloy Corporation also use the CO<sub>2</sub> gas hardening method. In this instance, the cores are made with core boxes having symmetrical halves. After each core is blown and gassed, it is rolled over onto a layoff frame to enable the lower half of the box to be mechanically vibrated off the core and permit withdrawal of the two loose pieces needed to form the valve seat.

Since the gate valve is a standard item, production runs are scheduled well in advance.

### New process much better

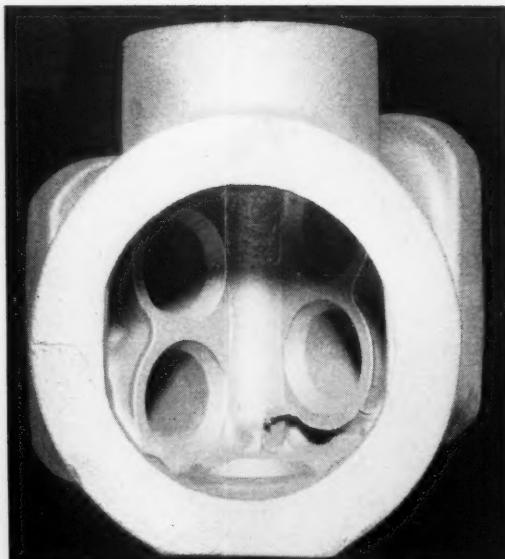
With the older baking methods, the number of cores blown at one time was limited by the number of dryers. When all these were in use, the run had to be stopped and another job set up on the blower. Not only did this involve considerable downtime (since the operation was repeated many times), but scheduling was difficult. In addition, a growing number of cores had to be racked until the foundry was molding valves.

COOPER ALLOY CORP.



*Stainless steel supporting feet for chemical tanks.*

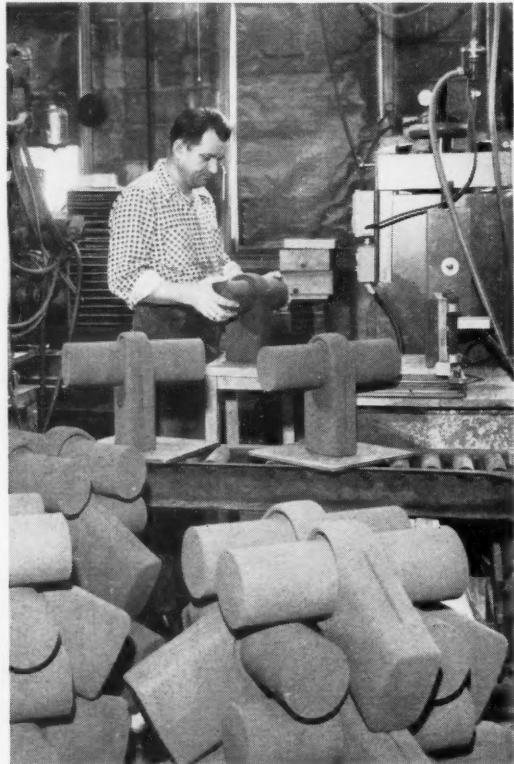
*Silicate-CO<sub>2</sub> core casting of a compressor housing.*



DU PONT

Now, the cores are run continuously and racking is necessary for only short periods, since the core room can comfortably work as little as an hour ahead of the foundry. ★

Readers requiring further information from Foundry Services (Canada) Ltd. should circle number 200 on the Reader Service Card at the back of this issue.



*Production of cores for a run of 4 in. gate valves.*

*Instead of overnight, this half core dries in 30 sec.*



COOPER ALLOY CORP.

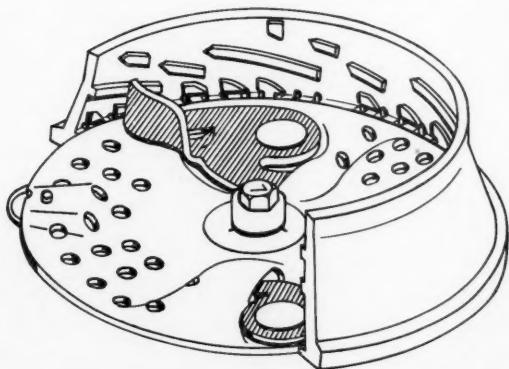
RIVERSIDE IRON & ENGINEERING

## Impeller design

# An impeller designed for fast liquefaction

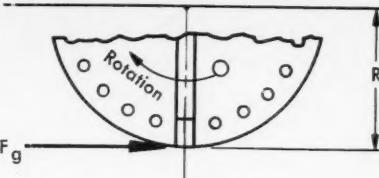
### Swivel impellers seem to solve the problem of jamming waste disposers

A drag impeller, developed by Waste King Corporation, combines the desirable features of conventional fixed and swivel impellers to increase both the efficiency and life expectancy of garbage disposers. Fixed impellers (A) molded to a disposer's turntable, tend to overload the motor driving the table and jam the disposer when stringy food waste, bones, metal or similar objects are introduced. A later development was the swivel impeller (B), designed to reduce jamming. This impeller retracts so as to free the turntable from its load of food waste when the liquefying force threatens to overcome the drive force and stall the motor. As table size and motor power are increased, however, the liquefying force generated by the swivel impeller does not increase proportionately. Thus, the impeller tends to pivot back from the liquefying ring before maximum abrasive force is achieved, and the full motor power is not utilized. The new drag impeller (C) makes maximum use of the motor power, yet retracts only when the liquefying force is actually sufficient to stall the unit.



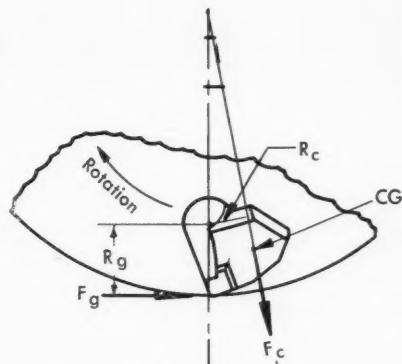
*Impellers (shaded area) are mounted on the turntable at the bottom of the disposer's liquefying chamber.*

### Types of impeller



A. Fixed impeller

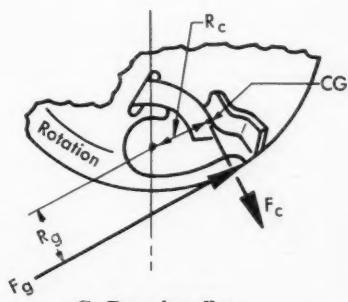
$$nF_gR = C$$



B. Swivel impeller

$$nF_gR_g = nF_cR_c = C$$

$$\text{and } F_g = \frac{F_cR_c}{R_g}$$



C. Drag impeller

Same except that  $F_g$  and  $R_c$  are of greater magnitude.

### Nomenclature:

$n$  = number of impellers

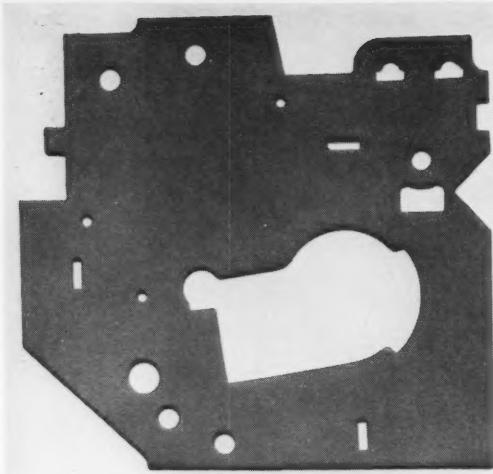
$F_g$  = grinding force

$R_g$  = radius to grinding force

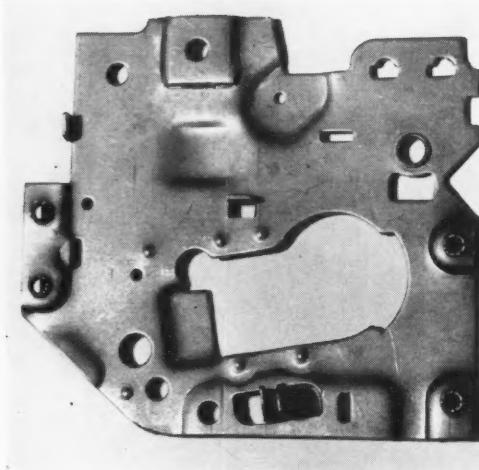
$F_c$  = centrifugal force

$R_c$  = radius to centrifugal force

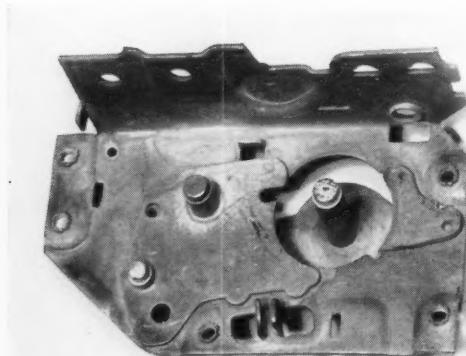
$CG$  = centre of gravity



**1a. Blanking operation**



**1b. Third operation**



**1c. Final operation**

## **Stampings: bargain basement versatility**

**Clever stamping design can turn out intricate parts in short order**

This is a pictorial feature on stamping design based on what we saw during a recent tour of S.K.D. Manufacturing Co. Ltd., Amherstburg, Ontario. It is hoped that it will be interesting and instructive.

Figs. 1(a), (b) and (c) show three of the five press operations (and one tapping operation) for a door lock plate.

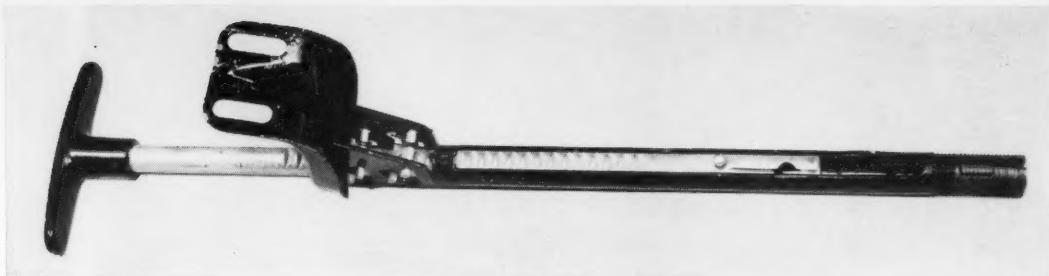
In the parking brake, figs. 2(a) and (b), there were four press operations and one threading operation on the tube. There are two press operations on the bracket. The assembly was projection welded. The shaft teeth were milled and the pawls had one press operation.

Projection welding, it should be mentioned, is essentially a spot welding operation. The basic difference between the two processes is that, while in plain spot welding the two sheets to be welded are both flat, in projection welding one sheet remains flat but the other receives bulges where the welding takes place. The projection welding process costs a little more but offers several technical advantages.

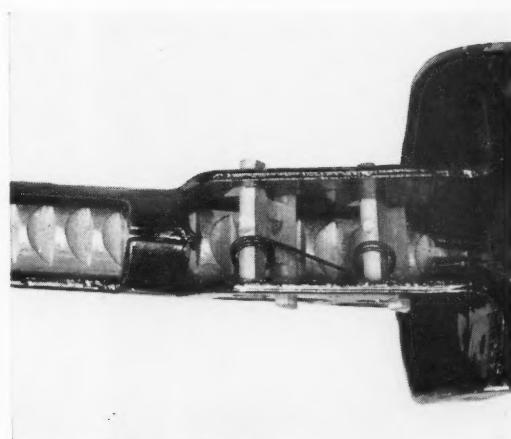
The possibilities offered by stamping have been fully taken advantage of, particularly in the way the threaded portion has been obtained by curving and interlocking part of a flat sheet to form a tube.

Fig. 5 shows the resultant part (it is a generator fan pulley) obtained from eight die operations on the hub, ten die operations on the pulley and one projection welding operation and one broaching operation. Further information on this part was not available. It is an even better example of what can be done by an intelligent combination of sheet metal stamping and machined parts. The savings in material and labor (that is, the over-all cost of the components) are enormous in comparison with similar parts produced by other manufacturing processes (casting, forging, machining and so on).

Fig. 4. There were eight press operations and two weld operations on this panel grille whilst Fig. 3 shows a part made by four press operations and one tapping operation. It is a steering-box shaft cover. ★



**2a. Handbrake assembly**



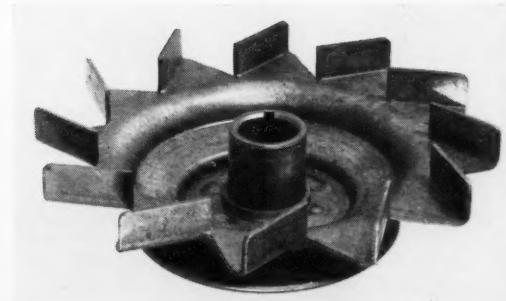
**2b. Release detail**



**4. Panel grille**



**3. Shaft cover**



**5. Fan pulley**

## **Reader response**

# **Here ▶ is what started it all**

## **Small item — big response. DE request snowballs to profit a reader**

Do you remember the item? It was tucked into DE's January issue on the regular Reports page at the request of a reader who wanted a problem solved.

Knowing that Design Engineering meets all the people in his field, he appealed to us for help.

If you read the item you may have wondered whether we had any response. We did.

*January 3:* A phone call from CGE, Carboloy Div. How about chrome carbide? They will put literature and samples in the mail to us immediately.

*January 6:* A letter from Hamilton Porcelains Ltd. "The problem involved intrigues us . . . let us know more."

*January 9:* A letter from Atlas Titanium Ltd. "Have you considered titanium? Titanium meets the requirements mentioned in your article. We are enclosing some literature. . . ."

*January 9:* A letter from Marani & Morris (architects). "When confronted with such a plea, we find it impossible to resist. We have found that the Vulcan Asphalt & Supply Co. Ltd., will custom design hot-process mastic asphalt linings and floor coverings to withstand all manner of attacks from chemicals and other special liquids normally considered harmful."

### **Wanted: an elusive material. Can you help?**

We are looking for a material which must have these properties; it must not deform at temperatures up to 350 F, be resistant to calcium chloride and to chromic and sulphuric acids in diluted form. Porcelain, which fits the requirements, is ruled out on the score that it fractures too easily.

Any readers with possible solutions will be doing the editors a favor by passing their ideas along to Design Engineering.



*CGE suggested their chrome carbide 608 as an answer.*

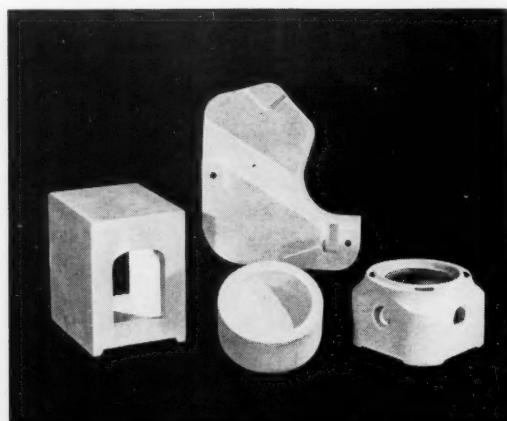
*January 9:* A letter from Canadian Johns-Manville Co. Ltd. "Electrobestos might be worthy of consideration for this application; it will definitely suit the temperature requirements and has some resistance to the reagents mentioned. We are enclosing data. . . ."

*January 14:* A letter from Industrial Cellulose Research Ltd. "We would like to nominate three candidates: Teflon, epoxy and silicone resins. . . ."

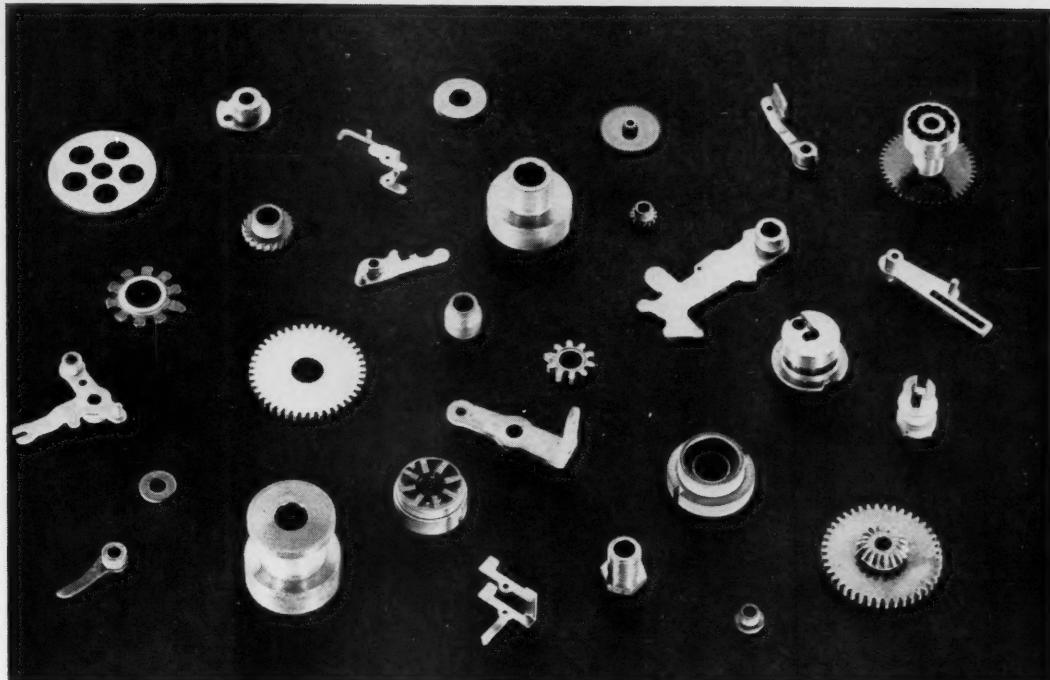
*January 18:* Letter from A. A Anderson & Co. Ltd. "Kindly furnish more information regarding the application . . . we have several products which will meet the general requirements mentioned."

Upshot of this exercise in information-seeking was that our original enquirer found a solution to his problem. That was not all. Amongst the literature that we re-directed to him he found a better way of doing another job which he had not thought of as a problem.

This is but a small sample of the way in which Design Engineering can serve you outside of its conventional rôle as your monthly technical publication. We stand ready to act as a clearing house for your ideas and problems too. ★



*Electrobestos was put forward by Johns-Manville Co.*



Samples of ballized parts in gear blanks, pulleys, collars, spacers, brazed and welded assemblies and so on.

## Precision balls make precision holes

### Ballizing gives holes uniformity and a better finish than machining

Ballizing is a method pioneered by Industrial Tectonics, Inc. for sizing and finishing holes by pressing a precision ball of suitable size and hardness through a hole. By doing so, holes are sized with a high degree of accuracy and uniformity, and finish is greatly improved compared with machined surfaces.

Unlike other hole finishing processes, ballizing does not remove metal; instead, it operates by a burnishing action, refining the surface structure and leaving a layer of denser metal. The base material is disturbed very little and acts somewhat as a cushion where tool marks, waviness and other surface imperfections are diminished by the pressing action of the advancing ball. Usually this result of cold-working is highly desirable, for work hardened materials have improved wear resistance and generally show less tendency to gall under pressure.

Holes (prior to ballizing) are machined undersize. As the ball is forced through the hole, the wall expands substantially to an amount nearly equal to the interference fit. Part of the total expansion is a function of the elasticity of the material and the wall springs back by that amount after the ball has passed. A portion of the wall deflection is, however, permanent, because metal is displaced by plastic flow. Thus, ballizing will enlarge holes close to the low limit of the suggested preliminary ream size more than holes close to the high limit of this suggested size (when using the same ball

under the same conditions). This results in a high degree of finished hole size uniformity.

Ballizing is being used successfully for diameters from 0.020 to 5 in., but hole diameters between 1/16 and 1 in. give optimum results.

#### Parts should be homogeneous

The material of the part should be ductile and homogeneous, with a minimum of porosity and sponginess. Often materials with hard spots (as in castings) are not suitable for ballizing, although there are examples of cast iron parts that have been successfully ballized. Equally important is the need for minimum variance in hardness from piece to piece. Materials above a hardness of Rockwell C 40-45 may not improve too much in surface finish. With the exception of cast iron (and other similar materials) the expected surface roughness improvement is 50% or more.

Seamless tubing in short length is excellent for ballizing. Long lengths may also be ballized provided an adequate method of forcing (or pulling) a ball through can be designed. Welded tubing can be sized by ballizing if the resultant camber (which may not be too pronounced in short lengths) is acceptable. Curved tubing, completely contained in a fixture, can also be ballized to advantage by using a sizing ball and a series of smaller pusher balls.

For the best results the following materials and machining methods (placed in order of merit) are best suited for ballizing:

**Materials:**

Sintered iron, sintered brass and other soft materials  
Aluminum, brass and bronze  
Mild steel, screw stock  
High carbon and alloy steel  
Stainless steel and other nickel-bearing alloys

**Machining methods:**

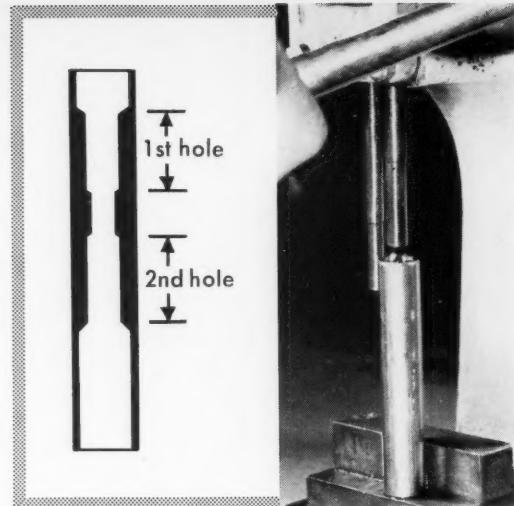
Tungsten carbide or diamond bored  
Reamed  
Die cast, drawn or extruded  
Broached  
Drilled

When heat treatment follows ballizing, precise size control is difficult. Ballized holes tend to change during the heating cycle, the amount of change varying from piece to piece. The inherent accuracy of ballizing is therefore lost. Improvements in finish are usually retained, however.

Heat treated alloys can be ballized, but benefits are less in the higher hardness ranges. A hardness limit of 42 Rockwell C is recommended.

Lubricants are required except when phosphate films, copper plating and like coatings are used. Waxes and sulfurized oils are satisfactory except for magnesium and some aluminum alloys, where special lubricants have given superior results. In the case of special materials, some experimentation may be necessary to determine the proper lubricant.

**Limitations:** Some holes cannot be finished by ballizing, although the process is well worth considering in most cases. Ballizing of inside diameters with partially interrupted bores or undercuts may be impractical since uniform sizing is generally not possible wherever the ball is not entirely confined by the ID. Parts with cross



In this cross section of two semi-blind holes the first hole, which is larger, is ballized first. The ball remains in the part. The part is placed under the adjoining smaller push rod (upside-down) and the ball is forced through and out of the mouth. A smaller ball is then dropped into the part and rests at the opening of the smaller hole. This hole is then ballized and the ball falls completely through the sleeve and the double ballizing job is completed.

holes with a diameter less than 25% of the ball diameter can be ballized if the holes are located symmetrically within the part hole. Additionally, the ball tends to follow the path of the hole and will not straighten curved or crooked holes. It will, however, improve to some degree elliptical, tapered or out-of-round holes, but will never bring them to complete perfection. ★

## CASE HISTORIES OF BALLIZED PARTS

Information for this table, taken from customer files, represents typical parts and their ballizing data

| Part                                 | Gear  | Arm   | Seal  | Drum    | Lever | Gear  | Gear     | Valve body | Arm   | Bearing | Gear  | Gear     |
|--------------------------------------|-------|-------|-------|---------|-------|-------|----------|------------|-------|---------|-------|----------|
| Material .....                       | 1020  | 1115  | 4615  | S.S.303 | Alum. | 1020  | Pow. Ir. | Brass 555  | B1112 | Bronze  | 1020  | Pow. Ir. |
| Hole machining method .....          | Ream  | Ream  | Ream  | Ream    | Drill | Ream  | Form     | Ream       | Ream  | Ream    | Shave | Form     |
| Hole diameter before ballizing ..... | .1914 | .1879 | .3400 | .1544   | .685  | .3580 | .4970    | .519       | .6252 | .1565   | .3402 | .484     |
|                                      | .1920 | .1887 | .3410 | .1564   | .686  | .3589 | .4980    | .521       | .6262 | .1570   | .3407 | .486     |
| Finish before ballizing (RMS) .....  | 20-28 | 30-50 | 50-85 | 50-70   | 60-70 | 36-60 | 26-45    | 40-62      | 28-42 | 30-46   | 40-60 | 36-52    |
| Type of ball .....                   | T.C.  | T.C.  | T.C.  | C.A.    | T.C.  | T.C.  | T.C.     | C.A.       | T.C.  | T.C.    | T.C.  | T.C.     |
| Ball diameter .....                  | .1941 | .1907 | .3452 | .1573   | .6891 | .3616 | .4984    | .5238      | .6307 | .1585   | .3433 | .489     |
| Hole diameter after ballizing .....  | .1930 | .1895 | .3400 | .1573   | .6868 | .3600 | .4991    | .5220      | .6285 | .1579   | .3420 | .487     |
|                                      | .1932 | .1898 | .3433 | .1577   | .6870 | .3604 | .4997    | .5224      | .6292 | .1580   | .3422 | .488     |
| Finish after ballizing (RMS) .....   | 7-9   | 8-15  | 20-36 | 22-34   | 30-36 | 14-24 | 12-22    | 7-14       | 12-18 | 5-9     | 7-12  | 10-18    |
| Holes per ball (thousand) ....       | 16    | 18    | 2.5   | 1.2     | 30    | 22    | 6        | 1.5        | 28    | 80      | 50    | 24       |

Legend: T.C.=Tungsten carbide; C.A.=chrome alloy.



*Underhull of the Canvik class tug showing the twin Voith-Schneider propellers powered by two 150hp. diesels.*

## Propulsion system eliminates a rudder

By Kenneth Macpherson

There are many interesting engineering features in the Voith-Schneider system of cycloidal propulsion, used for the first time in Canada on the tugboat Canvik I, built by Canadian Vickers Ltd.

The ship has no rudder and all manoeuvring is accomplished from the wheelhouse by means of two of these variable pitch propellers. They are arranged side-by-side and located about 15 ft aft of the bow.

Each propeller has four vertical blades of airfoil section with an axis of rotation approximately vertical. Only the blades are immersed in the water; all the other parts (including the rotor carrying them) are housed within the hull.

**Principle of operation.** Fig. 1 shows a diagrammatic plan view of a typical Voith-Schneider rotating propeller as fitted to the Canvik I. Four airfoil-shaped blades are installed on a runner rotating contra-clockwise about O.

The blade shafts are linked inside the runner to a spigot ring connected to an adjustable control point N. If N is at the centre O (Fig. 1 depicts this condition), all four blades have zero incidence and there is no resultant thrust in any direction.

When point N is moved to the left and the rotor is in the position shown in Fig. 2, blade A takes up a

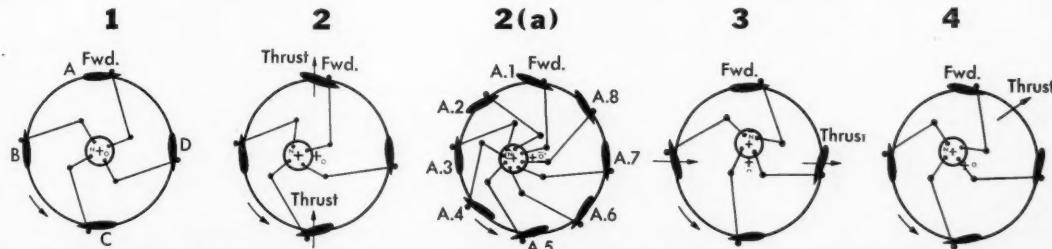
positive incidence, blade C takes up a negative incidence but blades B and D still remain at zero incidence. There is thus a net thrust (as indicated by the arrow) propelling the craft **forward**. The value of this thrust (and hence the speed of the vessel) depends, of course, on the offset of N to the left of O.

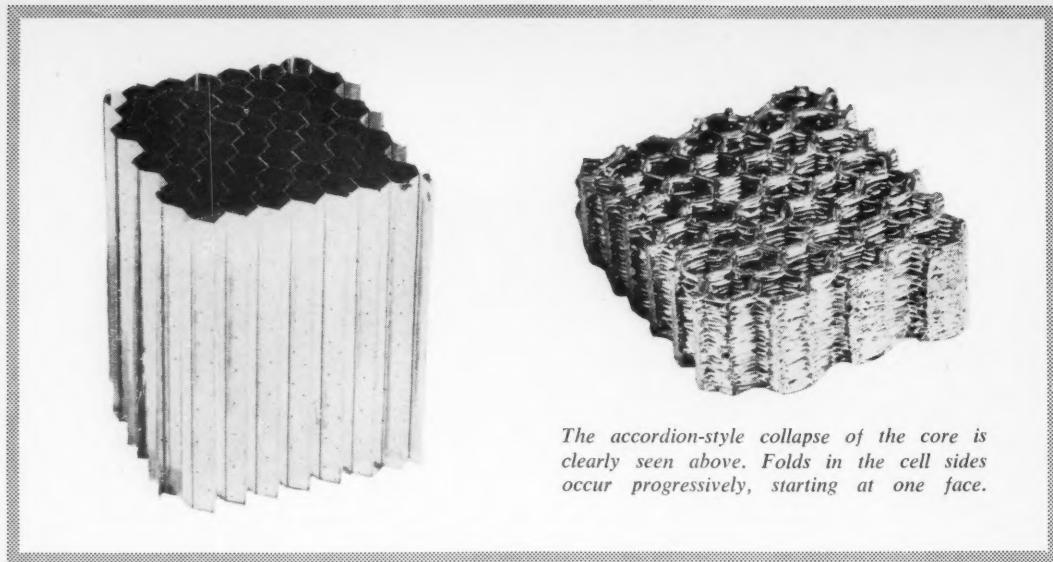
As the runner now rotates, the incidence of each blade automatically changes progressively from max incidence to zero incidence (or vice versa).

To show this, the path of blade A is plotted for a series of 8 positions ( $A_1$  to  $A_8$  inclusive) in Fig. 2(a). Position  $A_1$  corresponds to A in Fig. 1: by the time the blade has reached  $A_8$  it has zero incidence (like blade B in Fig. 1) whilst at  $A_5$  it has negative incidence (like blade C in Fig. 1) and at position  $A_7$  zero incidence again (like blade D in Fig. 1).

Similarly, if the control point N is moved to the right of point O there is a net thrust (see arrow) propelling the craft **backwards** whilst if N is moved forward (Fig. 3) the craft moves to **starboard**. If N is moved aft, the craft moves to **port** (not illustrated).

When N takes up some intermediate position (Fig. 4), the net thrust will propel the ship in a direction normal to the line ON, "turn to port." \*





*The accordion-style collapse of the core is clearly seen above. Folds in the cell sides occur progressively, starting at one face.*

## A honeycomb to absorb energy of impact

Aluminum honeycomb cores form an almost ideal material for impact energy absorption, according to Hexcel Products Inc., a principal manufacturer of honeycomb materials.

Extensive tests by defense agencies, correlated by work in their laboratories, have established that such a core collapses under impact loads accordion-wise, as shown. And while it collapses, it absorbs impact energy at a nearly constant rate.

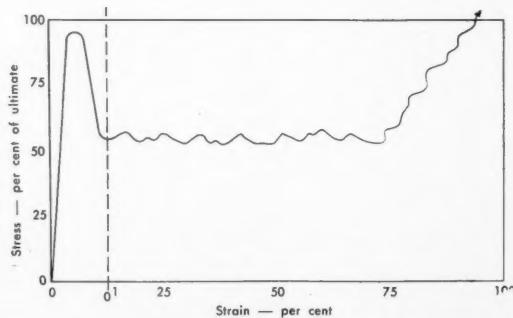
This makes the honeycomb structure an almost ideal material for reducing damage due to impact forces. When an automobile hits a telephone pole (or a crate falls off the end of a truck) the amount of damage sustained is, of course, a direct function of the rate of deceleration. Shock-absorbing materials lengthen the period of deceleration, by allowing the protected object to move slightly whilst coming to a stop. Most padding materials, however, deform in a non-linear fashion. The more the deformation, the higher the resistance to further deformation. An "ideal" shock absorber, on the other hand, presents a constant resistance (or force) during its total deformation. In this way, the deceleration force can be held at a constant g just below the damage level.

The constant resistance to deformation demonstrated by honeycomb comes much closer to duplicating the characteristics of an ideal shock absorbent. This is shown in the curve, which is a stress-strain curve for a typical honeycomb sample. The high initial peak represents the inherent characteristic strength of the core before failure has started. This is followed by a flat section (proportional in duration to the depth of core sample), during which the accordion action takes place. The final high plateau occurs after the absorbent core material has been completely crushed and is effectively a solid block of aluminum. The initial high peak is undesirable, since it may cause a momentary g beyond

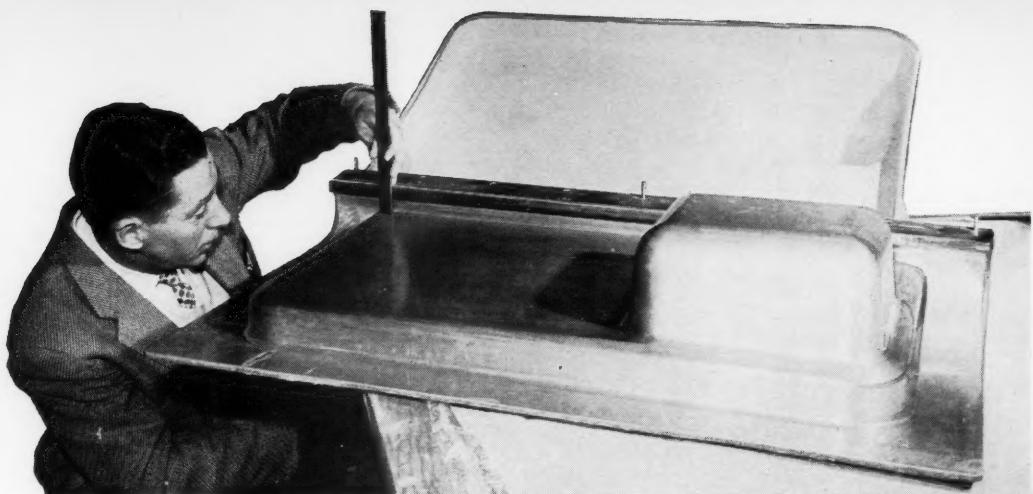
the design limits. Consequently, in most shock absorber applications, the core is deformed slightly before installation to a point just beyond the peak.

Hexcel research engineers have found that by densifying the honeycomb core cells with a foamed plastic, they can increase the stress-strain ratio and still retain the flat curve response of the deformation curve. In this way the linear deformation characteristics of the honeycomb core material can be applied to cases where higher g loads can be tolerated. For example, aluminum with  $\frac{1}{8}$  in. cells made up of 0.0015 in. wall thickness, has a crushing strength of approximately 350 psi. Filled with plastic foam, the crushing strength of the honeycomb core is increased to about 2500 psi.

Potential uses include industrial packaging, crash helmets, barriers on aircraft ground runways and carriers, and mounting panels for electronic hardware. In fact, any instance where g loads can cause destructive damage creates a possible application for honeycomb shock absorbers.



*Dynamic measurement of aluminum honeycomb core collapse shows an almost constant stress-strain ratio.*



Metal spray mold and (in the background) the glass fibre and polyester resin laminated sink made in the die.

## Looked at plastics for your tooling?

A method tailored to the relatively short production runs in Canada

E. J. Meldrum CANADAIR LTD. and J. R. Morris BAKELITE CO.

Lower costs, shorter tooling times and quality tools are the main reasons why designers in many industries are today taking a close look at plastics for tooling.

Already this versatile tooling method has contributed to the economies and flexibility desired by the aircraft and automotive industries, where many thousands of dollars are tied up each year in tooling.

In this country (where unit costs tend to be higher than in the U. S. because of the shorter production runs) plastic tooling could be particularly advantageous over conventional high cost metal tooling. The substantial savings in initial tooling costs by using plastics might make attractive, for the first time in Canada, the production of some relatively short-run products.

The trend to plastic tooling has been most noticeable in industries that use a large variety of metal-forming tools. The technique is, however, spreading to other manufacturing (such as foundries and plastic processors) and is used most efficiently, from the cost standpoint, in shaping parts with contours that require a lot of machining.

**Properties:** Some of the properties that have made epoxy resin formulations outstanding as new engineering materials, and particularly suited to tooling applications, include the following:

- They have the high mechanical strength, a favorable strength-to-weight ratio and good resistance to abrasion.
- Their excellent dimensional stability (both during and

### Development of plastic tools

The use of plastic tools can be traced to the late 1920s, but because of limitations in the resins, little progress was made until the late 1930s, when superior phenolic and polyester resins came on the scene. These showed some promise of having suitable dimensional stability. The war years led to the development of improved phenolics for tooling purposes. The major impetus came, however, when an entirely new series — the epoxy resins — was developed around 1952.

Today, all three of these resins are used for tooling, although epoxy-resins are dominant.

Successful applications include:

- jigs or fixtures for holding parts for various metal-working operations;
- gauges for measuring or checking;
- various dies for stretch-forming, hammer-forming, bending or drawing;
- patterns and cores for foundry work;
- in-forms for prototype or experimental work; in-forming-tools for plastic products.

## Plastic tooling continued

after curing) makes them suitable for tools where no pressure can be used during fabrication.

- The resins can easily be cured or hardened at room temperature, together with a hardening agent.
- They adhere firmly to a wide variety of reinforcing materials, including glass and synthetic, vegetable and mineral fibres.
- There is excellent resistance to weathering, to a wide variety of dilute acid and alkaline solutions and to many solvents. They are dimensionally stable at ambient temperature and will operate over a wide range of temperature (from -60 to +250 F).
- The resins have excellent forming characteristics and give perfect reproduction of the shape of the master. Their versatility is shown by the fact that the plastic tool can easily be patched and cured again.

**Methods:** There are two methods for making plastic tools: by casting or by laminating (and by combinations of the two).

In **casting**, resins are poured into a mould to harden, after the mould has been coated with a parting agent. Various fillers (such as glass fibres, wood flour, plaster, sawdust or metal oxides like aluminum oxide) are added to obtain the desired physical properties of strength, weight or stability. In addition, these fillers provide bulk and so further reduce the cost of the resin.

In **laminating**, glass cloth is impregnated with the resin and hardener and is laid successively on the model. The model or mould has previously been coated with a parting agent. When the desired thickness is obtained, the laminate is left to cure (harden) at room temperatures.

Laminating procedures with glass cloth offer particular versatility to plastic tooling. The impregnated cloth is completely pliable and so can easily be moulded to any shape, no matter how complex.

**Advantages:** There are several features of plastic tooling that lead to lower costs, shorter tooling times and other advantages over conventional metal tooling.

Simple casting and laminating methods are used that require no elaborate equipment. This comparative simplicity of operation means that semi-skilled operators can be used to turn out high quality work in a shorter tool-making time.

Reinforced epoxy tools keep to a minimum the need for machining, grinding and polishing.

If design changes are needed, plastic tools can be quickly and easily modified at low cost, by machining or adding more compound.

In some production operations, time can be saved if copies of master models are available. Epoxy resins provide a means for easily duplicating master models. It is possible to design for close tolerances, since the excellent dimensional stability of the epoxy resin remains throughout the life of the tool.

In the automotive industry, epoxy tooling offers interesting possibilities for short-run, experimental die production. These short-run dies are useful in starting production lines moving whilst waiting for initial tooling of the long-run metal dies. The advantage, too, of epoxy dies is obvious during design changeover as a means of keeping production moving.

The aircraft industry is one of the largest users of epoxy resins. At the Montreal plant of Canadair Limited, over eight tons of epoxy resins were used in their tooling shop during the past year. Canadair's comparatively short production runs makes the use of plastics the most practical and economical method.

In experimental die work, epoxy resins are being used to aid in the visualization of draw problems and practicability. Problems can be solved quite cheaply before costly metal tools are made.

Prototype parts can be made available quickly, accurately and economically by using epoxy tooling. Minor changes in the model can be accomplished directly on the epoxy tools. Even major retooling requirements are quickly and economically accomplished.

The excellent bonding properties of epoxy resins can be used effectively in marginal tooling applications. Steel reinforcement (to which an epoxy surfacing is added) can be an economical solution to certain tooling uses. Also, metal inserts can be imbedded in the plastic tool at points subjected to extreme wear.

*The reverse side of the tool shown on the previous page showing the reinforced backing of epoxy laminate.*



**Disadvantages:** Plastic tooling should not be looked upon as a cure-all. It has many strong points but there are some shortcomings that should not be overlooked.

Compared with tooling steels, reinforced plastics have low-strength limits. Though epoxy tooling is extremely durable, it is not hard enough to stand up under long production runs. However, epoxy tools can be cheaply re-surfaced to prolong their life. In Canada, the prolonging of tooling life may not be too significant, since production runs are shorter than in the U. S.

In casting large dies, some problems have been created by the high exothermic heats generated by the curing of epoxy resins. This property can be minimized by the use of special fillers and newer casting techniques.

Some of the hardening agents used to cure the epoxy resins can cause skin irritation. This can be controlled by adequate ventilating and sanitary facilities. New non-toxic hardening agents are now on the market that have overcome this problem.

**Future trends:** There seems no doubt that plastic tooling applications, correctly selected, will be used more widely in industry year by year.

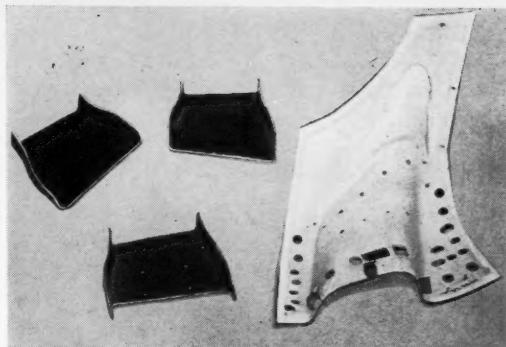
Aiding this growing use will be improved resins and techniques. Trends in this direction include:—

- High heat-resistant resins capable of withstanding higher operating temperatures.
- Harder and tougher resins that will extend the life of plastic tools.
- New metallic plated surfacing for some plastic tools to give longer life.
- Wider selection of tooling compounds.

Many large companies in this country are now building their own plastic tools. Some of the smaller firms may, however, find it more economical to purchase plastic tools from specialized companies who have the facilities.

Plastic tooling is a technique that each industry should evaluate for adaptation to its own particular needs. Intelligently applied, the technique is destined to become a major factor in the tooling industry because of the flexibility it offers the design engineer. ★

Zinc-coated plaster mold which has been reinforced with epoxy laminated panels bonded to the back covering.



Examples of shapes obtainable from plastic tooling.



Metal spray shell lay-up mold for production parts.



*Stud dryer gear that has been broken during start-up.*

A major improvement made by Dominion Engineering Co. Ltd. to paper machinery dryer gears is the introduction of single helical teeth. Spur teeth have one or two bands of elastically deformed contact extending across the face and alternately carrying the load, as shown in Fig 1.

Since profile inaccuracies are usually in an axial direction they will directly cause changes in velocity which, if large enough, might have some effect on operation. Also, with inadequate lubrication, this axial band of contact tends to cause progressive destruction of the tooth profile. In helical gearing (Fig 2) the load is carried along a series of straight lines of contact lying oblique to the teeth.

Even with angles as low as  $7\frac{1}{2}$  deg, an 8 in. face width and a 2 diametral pitch, the company achieves a 0.67 axial overlap. With the 15 deg helix angles now being recommended for new machines, an overlap of 1.32 is obtained. **Overlap** is a measure of helical action and is defined as the ratio of tooth advance (due to the helix) to the circular pitch in the plane of rotation. The thrust load is 13% of the tangential tooth load for  $7\frac{1}{2}$  deg

## Gear design when starting loads are heavy

In designing gears for the dryer rolls of paper-making machines, problems of expansion, noise, lubrication and durability are prime considerations, according to an article by R. E. Smallwood in "Dominion Engineer."

The dryer section of a modern newsprint machine usually requires more than 50 sets of gears (100 gears in all) ranging in diameter from about 20 to 29 in. A typical dryer section might have a width of 284 in. and be 175 ft long. The 60 dryer rolls of this machine would be 60 in. diameter and weigh 20,000 lb each.

helicals and 27% for 15 deg helicals, which means that the latter can only be used where adequate provision for thrust is made. With helical gears, the tooth curvatures vary along the line of contact, which means that we have different rates of sliding of the mating tooth surfaces taking place simultaneously.

**Advantages.** Some of the advantages for this type of tooth contact for dryer gears are as follows:

- (1) The dynamic loads are reduced and this provides a higher load-carrying capacity with less noise and vibration.
- (2) Lower internal stresses and therefore increased strength.
- (3) Smaller changes in angular velocity and therefore an improved product.
- (4) Inherent profile and spacing inaccuracies tend to be averaged out.
- (5) If wear takes place, the shape of the tooth profile is not materially altered (as it is with spur gears.)
- (6) The lower unit pressures of the teeth provide improved lubrication conditions and the skewing action

tends to dispose of foreign materials.

(7) Where there is misalignment the teeth will wear-in more rapidly.

(8) The overlapping feature provides continuity of action which should lessen the tendency for the gears to cause barring of the paper.

#### Variable centre distance

Open dryer gears are frequently required to operate on centre distances that are greater (or less) than the designed figure and it is sometimes questioned whether this still provides satisfactory operation.

The shape of the curve used on most gears supplied today is the **involute**. This may be defined as the path traced out by a point on a belt, as the belt is unwound from a cylinder. The point of contact of two involute gear surfaces when rolled together traces out a line that follows exactly the path of a crossed belt connecting two cylinders. When operating at different centres we are simply running on different parts of the involute curve. (See Fig 3.) The velocity ratio and proper tooth action are not affected.

In actual practice, the curved surface of a gear tooth is made up of only part of an involute curve. It is also necessary to make equally spaced and parallel involute tooth profiles on each side of the tooth, in order to transmit continuous uniform angular motion in both directions. Centres, of course, cannot be decreased beyond the point where there is insufficient bottom clearance, or increased beyond the point where there is too much backlash.

**Materials used.** It is seldom that machines built at different times have identical specifications and therefore an analysis of the tooth loading is usually necessary in order to select suitable materials. Modern new machines have as many as ten dryers per motor and some specialty machines are built with one motor per 20 or 30 dryers, with the number depending on the requirements for draw and limiting mechanical load on the gears. The dryer in-drive pinions are made of heat-treated steel which can be hardened up to 300 brinell if necessary. Idler gears can be made of plain or hardened alloy steel, depending on their proximity to the pinion and their loading. Cast iron is usually satisfactory for the dryer-mounted gears, although different grades are used, with alloy types provided for those carrying the heaviest loads. Accuracy of manufacture and mounting are almost as important as the type of material itself.

**Gear design trends.** Steps are being taken to establish standards for gear motors that combine the motors and gears in a single unit. This will probably be followed by mounting feet and shaft standards for the mechanical portion as well. The problem of non-interchangeability among different makes will therefore be eliminated and the economic and space-saving advantages of these units will probably be available in larger sizes than at present.

Gear sizes will eventually be reduced as advances in metallurgy and cost reductions are made in the production of gears with shaved or hardened and ground teeth. There has also been some progress made in the last few years in controlling the distortion associated with hardening after teeth cutting when using nitriding, carburizing, induction and other hardening methods. \*

### Lines of contact, effect of the changes in centre

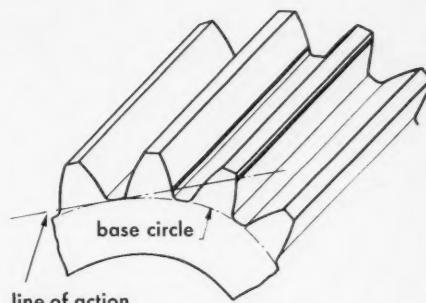


Figure 1

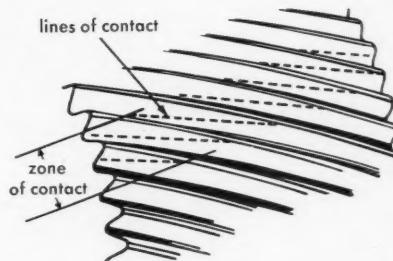


Figure 2

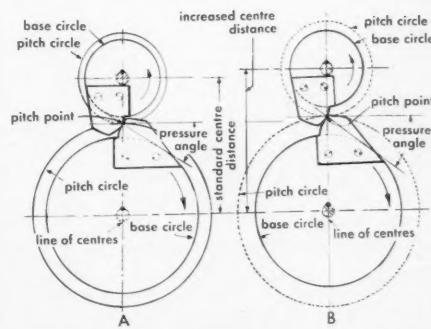
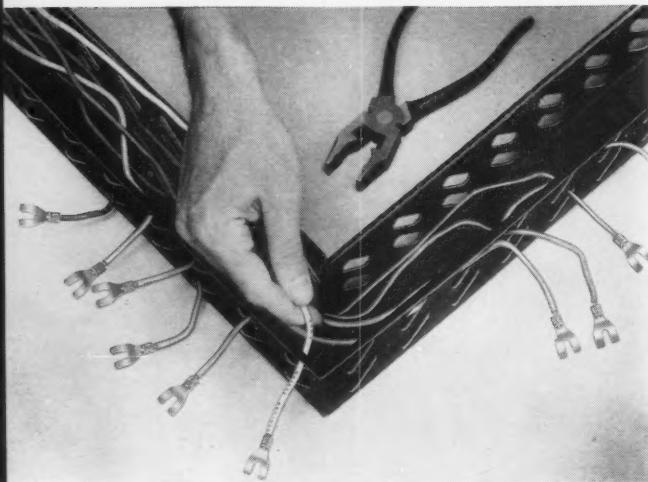


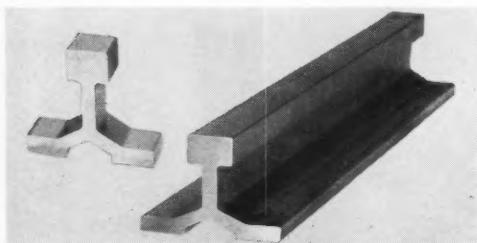
Figure 3

## Design news in pictures



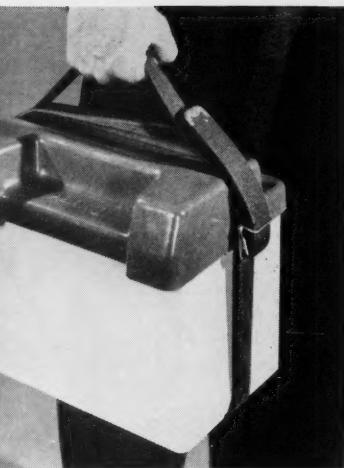
**Antidote for wiring headaches**

This phenolic channelling offers a method of wiring that should reduce work in panel design and construction. Chief advantage, of course, is found in the elimination of lacing up of wire bundles. (201)

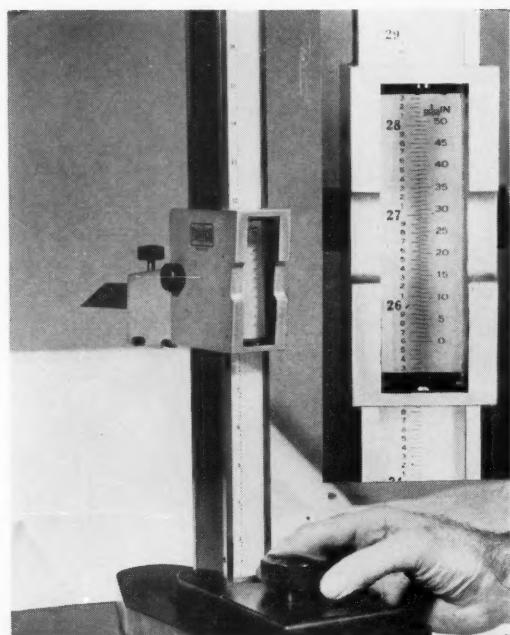


**Extrusions saved weight**

Switching to an extruded shape for rail sections on a flame-cutting machine, the manufacturer made a 35% weight saving. Once cast, the new rails can be extruded in lengths of up to fifteen feet. (202)



**Seagoing batteries**  
Neat plastic box for toting marine batteries between ship and shore has a turquoise colored lid molded of polyester resin glass and sisal filler. Box fits most batteries. (203)



**Super-accurate height gauge**

By using a glass scale and glass vernier, accurate reading of fractions of 1/1000 in. is possible on this new design of heat gauge. A reflector makes magnifiers and auxiliary lights unnecessary. (204)

**Tool engineer's "kit"**

A simple tool designer's layout kit is now available. Using actual size boring bar nose and cutting templates, the kit makes it possible for the tool engineer to design and preprice cluster boring bars. (205)



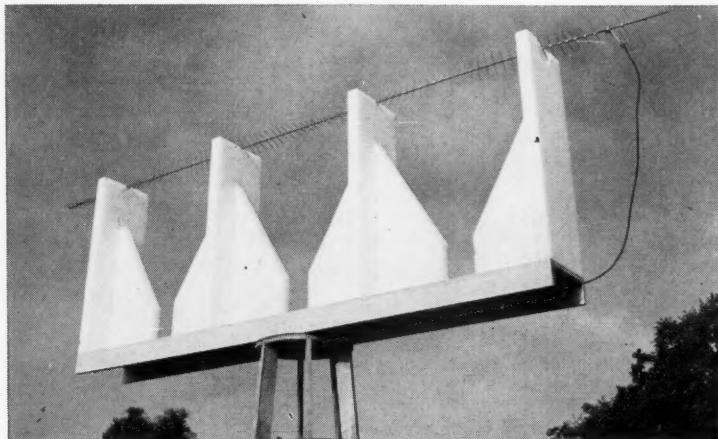
**Putting a fizz in**

Designed to give that extra zing to juices and cocktails, this device does the job by channeling air bubbles into the liquid while it does the beating. The housing is made from a three-piece die-casting. (206)



**Wow!**

Seems there's a fellow with Atomics International who has made a number of zany instruments and we thought you'd like to see the cello that . . . shucks, it's some design, ain't it? (209)



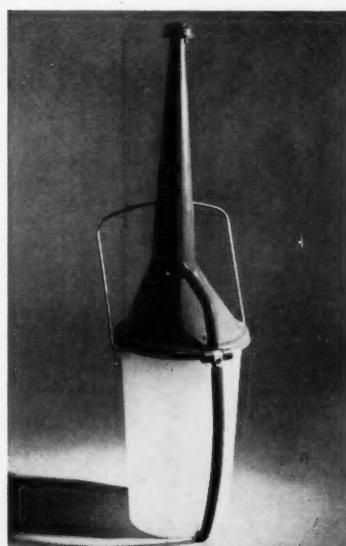
**The twisted Yagi**

Maybe there's something here for TV owners in fringe areas. By twisting the parallel rods on their supporting axis the length limitation of the Yagi antenna is extended considerably. Shot is of a model. (207)



**Iron-jawed wall gripper**

This is intended for use on jobs where it is necessary to have a bolt in place before tightening-up. When the nut is tightened, the wedged bolt head forces the segments of the expansion shield outwards. (208)

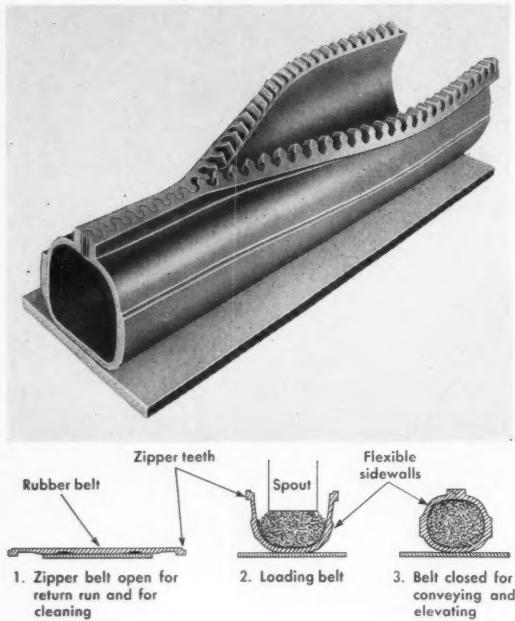


**Garden tool**

Unconventional design for a watering can has been achieved by a fresh analysis of the user's requirements and the demands of mass production. The item comes from Great Britain. (210)

# Ideas round-up

## Zipper conveyor: improvements on a smart idea



New features have been added to the highly successful Zipper conveyor (a Stephens-Adamson Manufacturing Co. closed-belt-type).

Literally a moving, material-carrying conduit, the Zipper is capable of transporting bulk materials in any plane, to considerable heights and around obstructions. Its great advantage is that bulk materials may be conveyed within the belt completely sealed and dust-tight.

In earlier designs the tube was formed between two sidewalls (and a portion of the basebelt) joined together by hinges. Instead of three pieces, the new design features a tube formed of one piece of flat rubber with teeth along the edges. These teeth interlock as the belt closes to form the rounding rectangular conduit. Reinforcement pads keep the belt approximately rectangular in shape (rather than as a flat oval) thereby providing a larger cross section. Fabric has been imbedded in the rubber of the tube to provide strength against tearing and cracking. Easy and effective cleaning of the belt is possible as it passes in a flat position around flat face pulleys.

In actual operation the traveling Zipper Belt opens to a troughing position to receive bulk materials from a feed point and is automatically zipped closed by a system of rollers, enclosing the load within rubber sidewalls. The load is moved to the point of discharge and the belt automatically "unzips" and unloads. (211)

## Adhesive: it resists aircraft fuels

By using an adhesive that resists attack by aircraft fuels of every type, Pratt & Whitney Aircraft produces a tight, long-lasting bond between the seal and the diaphragm support of the water-injection regulators used for Double Wasp and Wasp Major engines.

Known as Ray-BOND R-81114 (formerly R-114), the bonding cement is one of the synthetic-rubber, phenolic-resin-base types made by the Adhesive Department of Raybestos-Manhattan, Inc. It replaces the Buna N base cements found to have insufficient resistance to aircraft fuels.

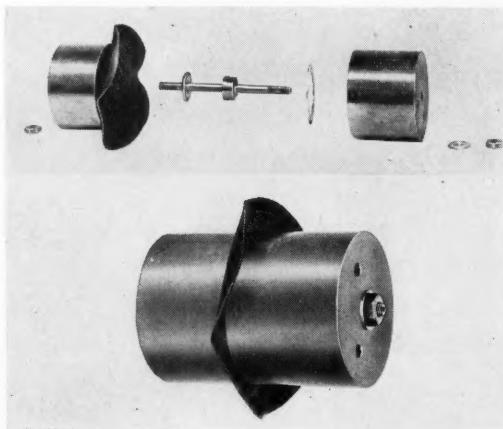
Engineers have found that by using modern adhesives for assembling the seal to water injection regulator supports (instead of pinching the seal into the seat), improved seating characteristics result.

In this particular application, the seal is cemented to the seat. The supports are slightly concave and have micro-grooves on the faces which come in contact with the diaphragm. This new design (plus varnish treatment of the supports), improves diaphragm retention, reduces the possibility of distortion and damage and improves corrosion resistance.

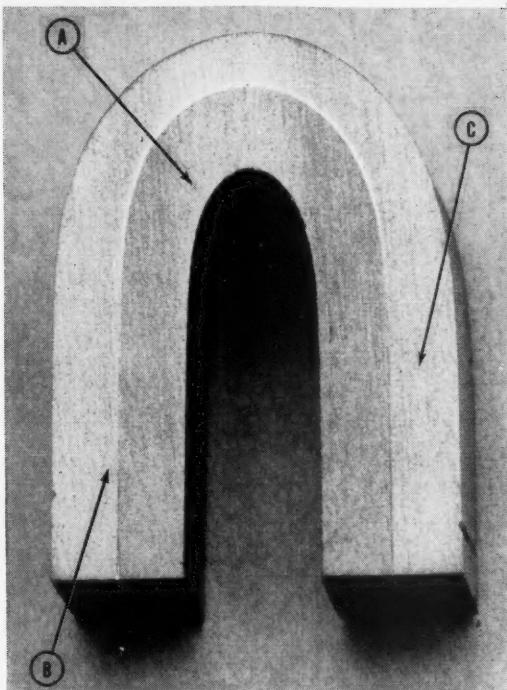
Some of the fuels used in aircraft contain as much as 30% aromatics, which are particularly harmful

to most adhesives. The Ray-BOND adhesive for the seal resists not only aircraft fuels of this type but also alcohol and piston-engine oil. It is unaffected by the operating temperature range of -65 to +400 F.

The joint is highly resistant to fatigue. (212)



## Metal cladding



a. High-temp metal; b. brazing alloy; c. the cladding.

Metallurgists at the Stanford Research Institute are considering various ways of solving the problem of metal oxidation under high-temperature conditions.

One approach to the problem offers considerable promise for the near future. It involves protection of the high-temperature metals by cladding them with oxidation-resistant metals, using a high-temperature brazing alloy as the bond. Several new protective metal combinations have thus been developed which provide high structural strength and high resistance to oxidation and deterioration for extended periods at extremely high temperatures. Some of these employ metals for which successful bonding has not been previously achieved.

Effecting the cladding of the high-temperature metals, however, is difficult because of the high temperatures required during the process. Under such conditions, these metals react with even minute percentages of atmospheric gases and become very brittle and weak. The gases also act upon the brazing metal resulting in a weak and intermittent interface (or joining area), bonding the high-temperature metal to the oxidation-resistant metal. In addition, many otherwise satisfactory high-temperature brazing alloys react with the high-temperature metals to form extremely brittle alloys at the interface.

To eliminate these undesirable conditions, high-vacuum and high-purity inert gas techniques are being employed in the cladding process. By thus removing all but negligible amounts of oxygen, nitrogen or moisture, firm, strong bonds are achieved between the high-temperature and the protecting oxidation-resistant metals. Columbium, for example, has been successfully clad with various stainless steels, high-nickel alloys and proprietary alloys to withstand very high temperatures. (213)

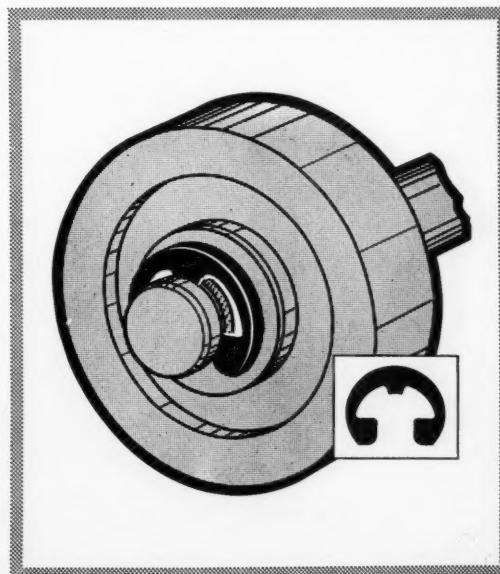
## E-ring: a boosted gripping strength

A radially-installed reinforced E-ring with about five times as much gripping strength (and 50% higher rpm limits) as conventional fasteners, has been developed by Waldes Kohinoor, Inc.

Known as the Truarc Series 5144, this retaining ring is designed for use in the automotive, aeronautical, electronics, electrical appliance and other industries in applications where conventional E-type rings do not provide the necessary holding power. The fastener is particularly suitable for assemblies where the ring is subject to strong push-out forces resulting from heavy vibration and shock loads, high rotational speeds or relative rotation between the retained parts. It may be used with abutting retained parts having large corner radii or chamfers.

The Series 5144 differs from conventional E-rings in that it has a heavy web section with tapered bending arms. This patented construction develops a substantially greater spring pressure with no increase in permanent set. To further increase the ring's gripping power, the entrance gap has been narrowed and the inside of the lugs made parallel at the gap.

Standard material is carbon spring steel (SAE 1065-1090); standard finish is oil-dipped. Other materials and finishes are available where required. (214)

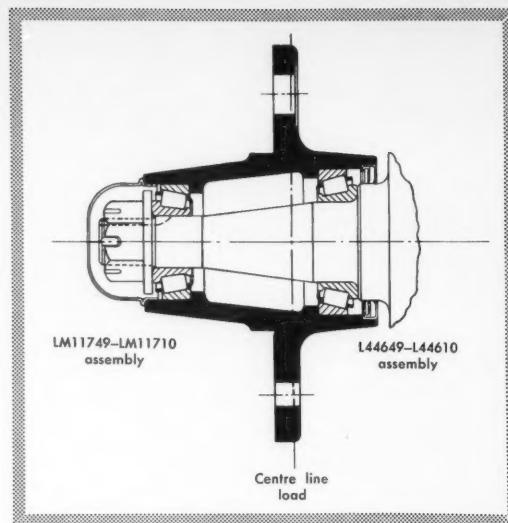


### Bearings: for the small auto

Two wheel bearings, with a high capacity rating for their size, have been developed by The Timken Roller Bearing Company for use in small economical automobiles. Although designed specifically for small cars of the European type, the new products will also fill any possible wheel bearing requirements if this type of car were eventually built in this Country. The smaller size bearings will provide additional savings in hub materials and allied parts, such as seals and nuts.

In addition to automotive applications, the bearings can be used wherever there is need for an economical bearing in this size range. Use of the bearings for farm machinery, boat trailers, small conveyors seems likely.

The larger bearing has a bore of 1.0625 in., an outside diameter of 1.980 in. and a width of 0.560 in. The smaller bearing has a bore of 0.6875 in., an outside diameter of 1.570 in. and a width of .545 in. (215)



### Motor: for constant cooling

Just made public by Air-Marine Motors, Inc.: their new, high-speed, high-slip, 3 phase 400 cycle motor. This motor automatically changes speed with varying altitude and density to provide constant cooling efficiency over the entire height range from sea level (high density) to 70,000 ft (low density).

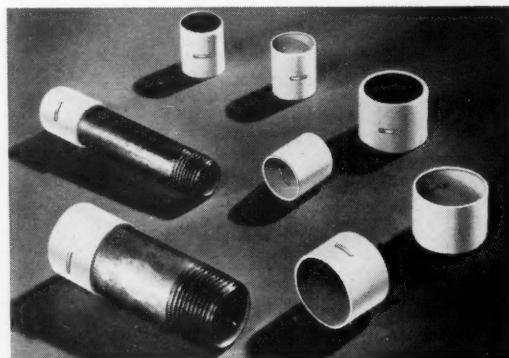
The E2123-200 motor (used in conjunction with a 4 in. diameter impeller), delivers 145 cfm at 0 in. S.P. at sea level and changes speed to deliver 440 cfm at 0 in. S.P. at 70,000 ft. This motor is rated at a minimum life of 1,000 hr at 125 C ambient and its life expectancy increases with lower ambients. The motor weighs 1.4 lb. It can also be produced in single phase 400 cps or variable (320 to 1,000 cps). (216)



### Thread cap: snap on — screw off

Thread protector caps that snap on instantly yet will not come off unless unscrewed, are now available. This is an important feature not found even in considerably higher cost types, such as molded polyethylene protectors. It has been accomplished by means of an ingenious metal staple (patent pending) that snaps into and conforms to the thread pattern. Thus, the new cap can be depended on to hold firmly regardless of vibration and jarring during shipment, handling, installation or actual plant use, as well as during storage.

Made from plastic coated kraft paper (by Precision Paper Tube Co.) and produced on high production machinery, the new tubes are extremely cheap. The kraft paper affords ample structural strength for practically all applications and conforms closely to the surface for a snug fit to keep out dust and dirt. The plastic coating insures protection against moisture, grease, chemicals or other conditions that might cause corrosion or rust.



Known as Tecto-Caps, the new protectors are furnished in standard diameters to fit all pipe and rod sizes up to 1 in. They can be supplied in closed (or open) end types and are available for immediate shipment in any production quantity. (217)

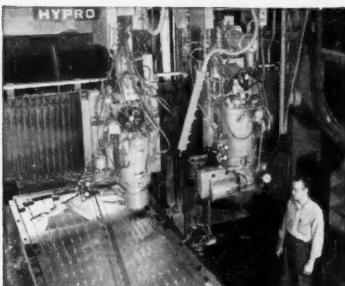
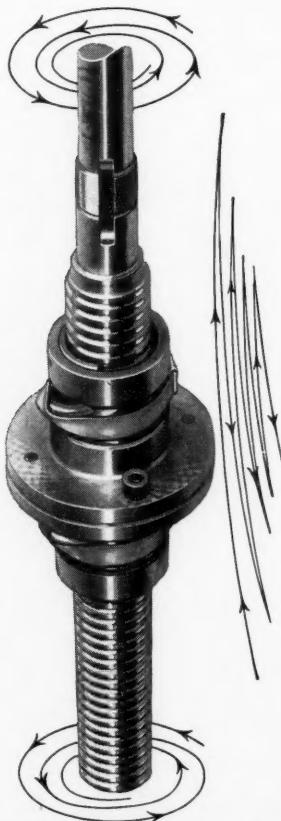
# VISIT BEAVER - BOOTH 416

1958 DESIGN ENGINEERING SHOW  
INTERNATIONAL AMPHITHEATER — CHICAGO, APRIL 14-17

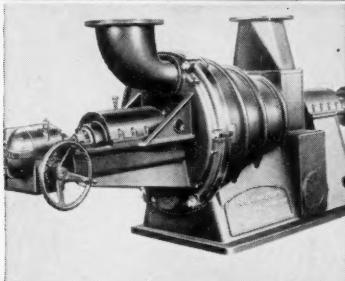
Beaver has given the ball screw, far older in principle than any of its present manufacturers, a new importance. Beaver Ball Screws, for converting torque to thrust, are of such precision that builders of machine tools and other power equipment requiring extreme accuracy are rapidly turning to their use for controlling the positioning of heads, etc. As an example of a Beaver attainment, a ball screw was recently delivered in which the cumulative lead error was less than .001" in approximately 11 feet of

ball thread! This was regarded as impossible to achieve until Beaver did it. Beaver Ball Screws, preloaded and free of backlash, with low breakaway torque and high reversibility where required, provide the precision and efficiency demanded in adapting numerical control to machine operations.

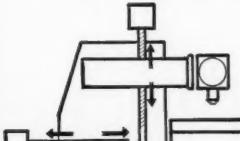
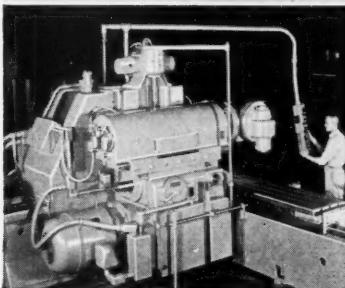
Beaver Ball Splines offer like precision and efficiency in eliminating the friction of sliding splines and keyways.



Four Beaver Ball Screws automatically position heads and swivel work chuck of numerically controlled skin mill.



Beaver Ball Screw permits fast easy adjustment of blades for control of stock characteristics in paper Jordan.



Here Beaver Ball Screw raises 14,000 pound machine tool head with 4 H.P. motor and without bulky counterbalancing.

Beaver Ball Screws are engineered to the specific application and not to preconceived standards. Can we help you improve your product? Literature and engineering consultation service available. Write now.

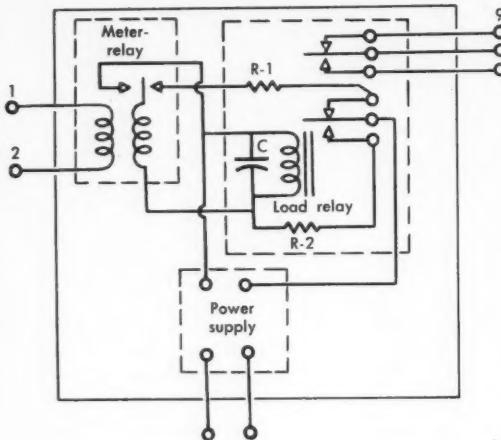
THE BEAVER MEN AT OUR BOOTH WILL BE QUALIFIED TO DISCUSS YOUR PROBLEMS.

**Beaver Precision Products Inc.**  
CLAWSON, MICHIGAN

### Voltage monitor: answer to a special problem

A problem arose when it was necessary to detect a change from a normal level of 1.6 volts rising rapidly to 2.0 volts. Relay must reset automatically when voltage returns to normal. No hunting nor over-shoot allowed.

This was accomplished by Assembly Products, Inc., with a San Gorginto 2304-INT voltage monitor having double contact, cycling circuit with interlocked load relay. The meter-relay in the monitor was design-



ed for high torque and deadbeat damping (no overshoot). The high limit was set at 1.9 volts and the low limit at 1.7.

At normal 1.6 volts the moving contact rests on the low limit. When the voltage jumps to 2.0 the moving contact rises rapidly to the high limit; the load relay pulls in and locks. It stays locked until the voltage returns to normal, allowing the moving contact to drop back against the low limit and release the load relay. The internal circuit of the monitor is shown in the diagram.

Voltage monitors are made for any level from 1 millivolt to 500 volts, either ac or dc. Also, there are current monitors ranging from 5 microamps to 10 amps; higher ranges with external multipliers. Most ranges have an accuracy within 2% but 1% can be supplied. More sensitive ranges at reduced accuracy go down to 0.1 millivolts or 0.2 microamps. Ranges below 250 millivolts ac include a small step-up transformer. Low range monitors are protected against accidental overload by Stabistor diodes.

In addition to the interlocked cycling circuit shown, there are limit monitors with external reset for high limit, low limit and double, high and low. These are also available with internal automatic reset and with self-releasing or pulsing load relays.

These monitors are complete with internal meter-relay. They can be supplied also with external indicating meter-relay. (218)

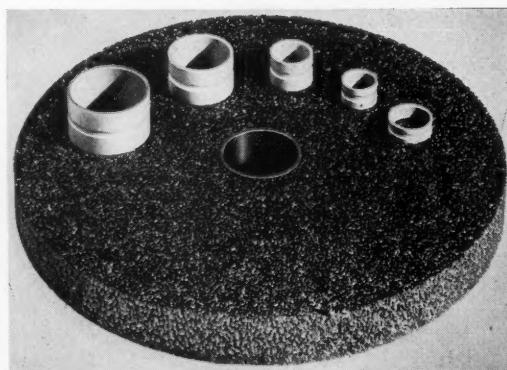
### Paper bushings: dimensional stability at high temperatures

All the grinding wheel bushings and sleeves now made by Taylor Fibre Co. consist of a laminated paper tube that has excellent dimensional stability at elevated temperatures.

Known as grade XX-13, the material is a paper-base phenolic resin laminate specially developed for use in grinding wheels cured at high temperatures, including those cured at temperatures higher than 300 F without pre-heating.

The bushings eliminate scoring of arbor when changing wheels. They are held to close size tolerance to eliminate the need to refinish the bushing or true the wheel. They cost less than aluminum bushings, because of the lower material cost, and less than bushings cut from laminated plastic strips, because of the easier assembly into the wheel.

The laminated plastic surface comes in direct contact with the steel arbor on which the wheel is mounted and, because of its natural bearing surface, prevents galling and wear of the arbor in the event of a spinner (spinning of the wheel on the arbor when the clamp plates are too loose). (219)



The laminated plastic bushings are available with a grooved centre and with a sanded or roughened surface to give a better bond between the bushing and wheel.

# are your plans as precise as your planning?

The proof of the planning is in the finished plans. That's why you're smart to use Eagle TURQUOISE—the pencil that tops 'em all for reproduction. Look what it gives you: Uniform grading (17 scientific formulas guarantee exactly the blackness you want—from every pencil, every time!). A strong non-crumbling needle point that stays sharp for line after long line of unchanging width. Inimitable smoothness—thanks to Eagle's exclusive "Electronic" graphite—TURQUOISE makes your plans look sharp—and you, too!



## EAGLE "CHEMI \* SEALED" TURQUOISE DRAWING 2H

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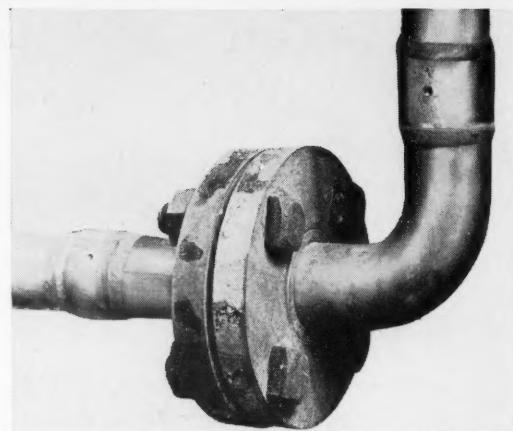
### Welding stainless piping

Stainless steel piping can now be welded quickly by using a new aligning connector, recently announced by the Speedline Division of the Horace T. Potts Company. The new connector fits over the ends of the connecting sections, permits in-place assembly of pipe and fittings and helps to align the system.

Another advantage is the elimination of icicles inside connections. Such icicles impede fluid flow and cause turbulence in the line.

Aligning connectors are specially designed for use with lightwall stainless steel pipe, Schedules 5 and 10 and Speedline fittings. They also connect with conventional Schedule 40 systems. Since lightwall piping systems eliminate threading at joints, excess pipe wall is not needed to provide the thickness required for screwed joints.

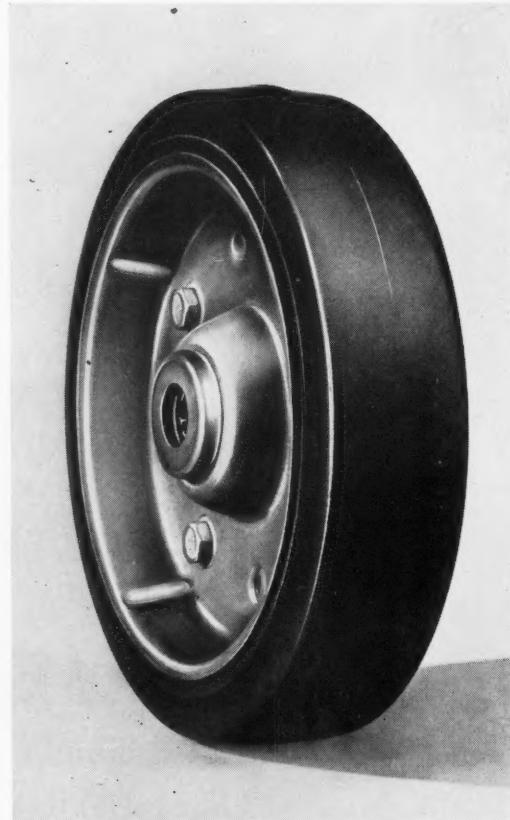
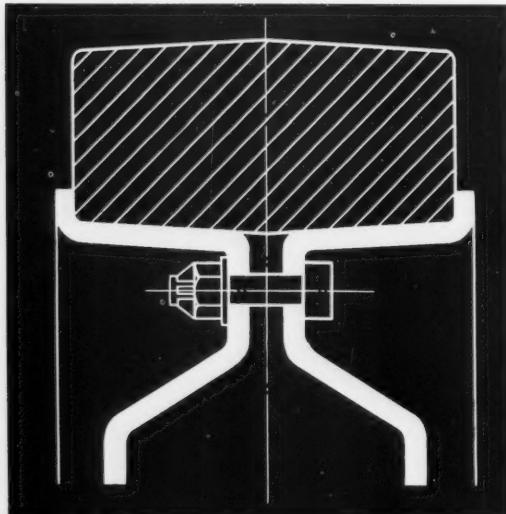
Speedline fittings include a full range of formed fittings, flanges, and unions designed especially for use with lightwall stainless steel piping. If welding is not



practical, connections may be made by soldering or brazing. Since all fittings are manufactured to IPS sizes, the changeover of existing lines to lightwall pipe presents no problem. (220)

### Caster wheels: tire changes without replacement

A unit known as the Albion demountable wheel (United Steel Corporation Ltd.) enables the user to change tires without replacing the caster wheel unit, it is claimed. All tires are  $1\frac{1}{16}$  in. thick for maximum cushioning and service life. Formed side plates are of 12 gauge steel, bolted over a tubular steel hub containing the roller bearing. All exposed parts are cadmium plated for corrosion protection. Tires are replaced simply by removing 4 bolts which retain the entire assembly. The special design prevents any slip between the tire and the side plates and enables the caster to handle heavier loads. (221)





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# Adjustable boards take a test

**Proof once again that the adjustable board saves time, an aching back too**

In order to find the time saving possible with modern drawing tables, the geometric figures shown were drawn (full size), with one row on the upper part of the board, one row on the centre portion and the other on the lower part of the board. The tests were carried out on:

- (1) a flat board equipped with a straight-edge.
- (2) a UNIC (Norman Wade Company Ltd.) adjustable

board with a straight-edge.

- (3) a UNIC adjustable board equipped with a UNIC-ISIS drafting machine.

Geometrical figures were chosen for the tests so as to reduce the repetition factor. For the same reason, the tests were conducted on every second day. The same draftsman made the tests; he was well acquainted with all types of equipment.

All possible precautions were taken to make the tests reliable.

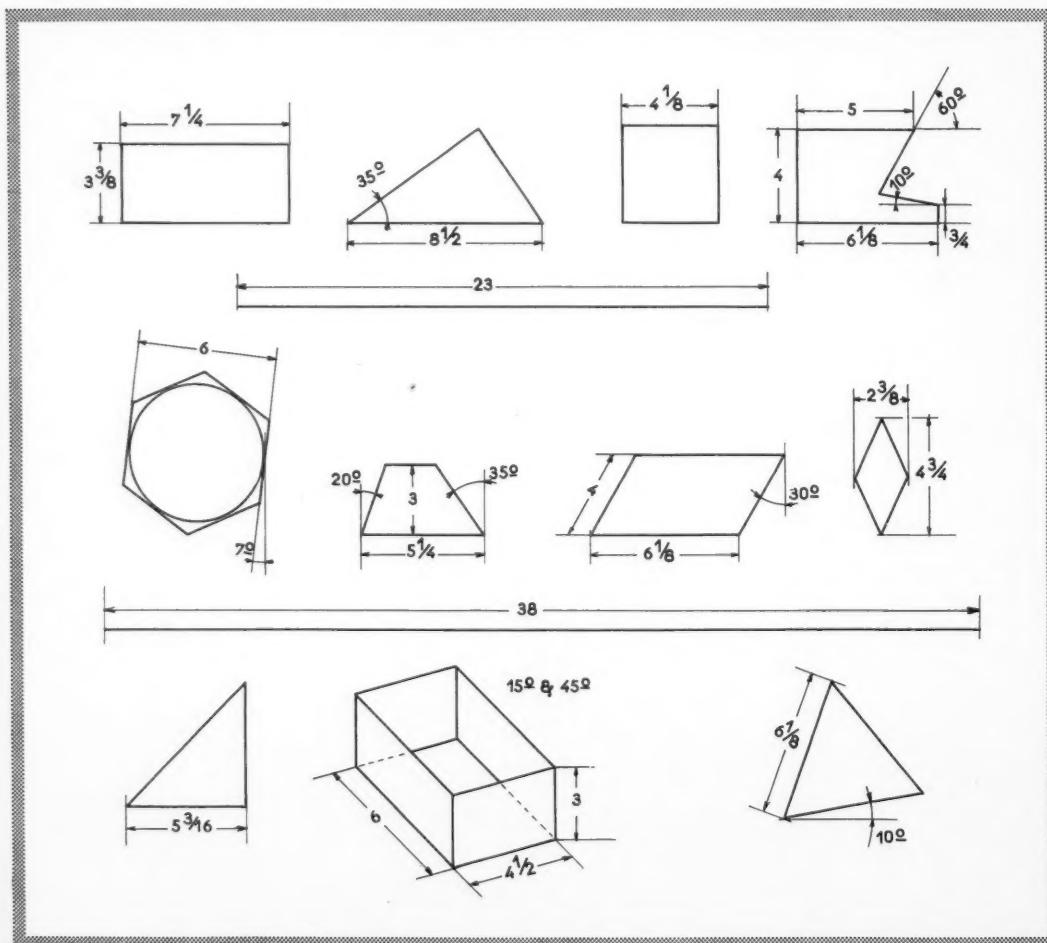
## Results:

**Test (1)** Flat board with straight-edge. Time for completion was 46 minutes.

**Test (2)** UNIC adjustable board with straight-edge. Time for completion was 33 minutes, 45 seconds. This represents a time saving over Test (1) of 26.5%.

**Test (3)** UNIC adjustable board with UNIC-ISIS drafting machine. Time for completion was 21 minutes, 30 seconds. Time saving over Test (1) was 53%.

It should be noted that during Tests (2) and (3), the draftsman was seated about twice as much as in Test (1), that his posture was correct (whether seated or standing), that he developed no backaches and his eyes were less tired. The draftsman also had the impression of working more slowly when using the adjustable boards (the time-keeper watching him felt the same), yet, as the results show, time was saved. \*



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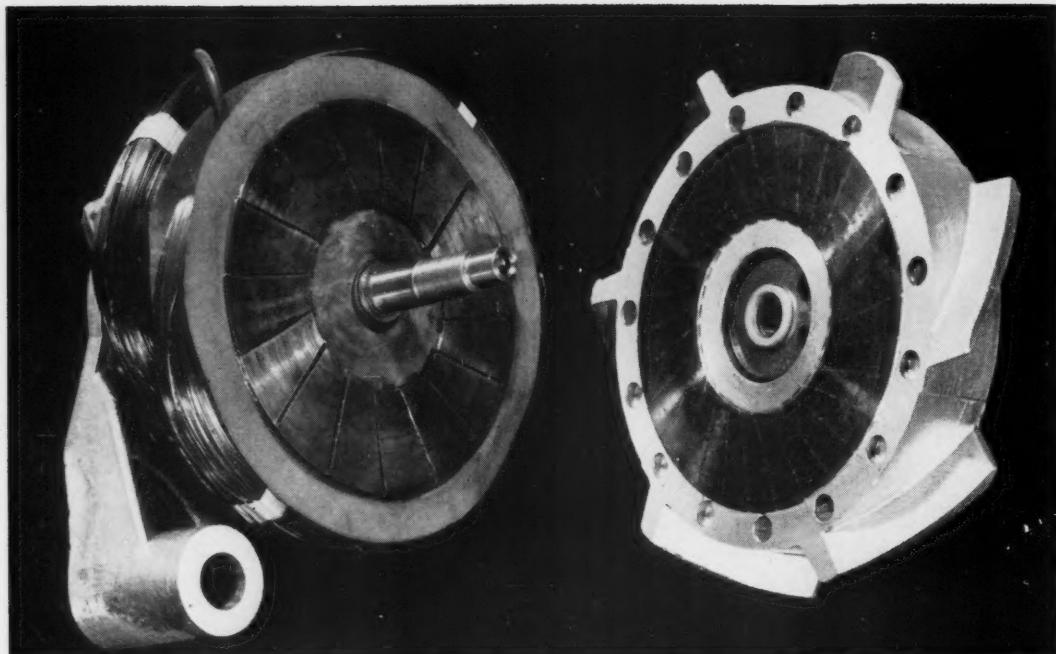
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*The disc motor (shown here with stator and rotor separated) is built around the internal bearing assembly.*

## Disc motors save on length and weight

The disc motor operates in precisely the same way as a conventional induction motor and retains its sturdiness, performance characteristics, versatility and simplicity. The essential difference between the two is in the stator and rotor and their relationship to each other.

With a conventional motor, the rotor is cylindrical and revolves inside the stator, separated from it by a small **radial** air gap. With a disc motor, both the rotor and stator are disc shaped, and the rotor revolves alongside the stator, from which it is separated by a small **axial** air gap.

The Limit Engineering Group Ltd. motor is built around the internal bearing assembly and this gives a marked reduction in over-all length and weight, does away with the need for a rigid frame and end brackets, and eliminates any inaccuracy due to the machining tolerances on these components. A light pressed cover is fitted over the motor when it is exposed, to prevent contact with the live and moving parts.

In some respects, the disc motor is considered complementary to the conventional induction motor. In others, the disc motor has marked advantages. As a flange-mounted motor it has an overhang length about half that of the equivalent conventional motor. It is considerably lighter and more compact and can be built to suit the contours of machine tools, domestic appliances or office machinery.

The disc motor rotor has an inertia about twice that of a conventional motor. This flywheel effect is an advantage, for it reduces speed fluctuations in compressor drives (and the like) where load variation occurs.

With a conventional motor the magnetic pull between stator and rotor cancels out. With the disc mo-

tor the magnetic pull acts along the shaft and is used with advantage in certain designs to give practically instantaneous braking of the rotor. For this purpose the magnetic pull gives a slight axial movement of the rotor so that the rotor engages the braking equipment immediately the stator is de-energized. Stop motors of this type have the shortest possible braking time, are considerably cheaper and smaller than the conventional type. They are being used for driving lifting blocks, spin dryers, precision machine tools, centrifugals and for drives where accurate and automatic control is necessary. A similar use is made of the magnetic pull to effect automatic engagement and disengagement of the load; for other applications the magnetic pull is made to preload the motor bearing, giving very accurate shaft location.

The maintenance necessary for a disc motor compares favorably with that of any other motor. It has fewer parts than any other type of industrial motor, the mechanically stressed parts are reduced to a minimum, and the motor can be run for examination with its working parts exposed. The bearings are well protected (although easily accessible) and damage by the rotor to the stator at stripping and assembly is impossible. \*

| Conventional Motor | Disc motor  |
|--------------------|-------------|
| Weight             | 100%        |
| Length             | 100%        |
| Diameter           | 100% - 120% |

## Abstracts

### Acid pump

A small rotary pump has given excellent service in handling 30% HCl at Hoffmann-LaRoche, Inc. It followed a succession of unsatisfactory acid pumps in a production unit.

Key to the pump's success is its novel design. All moving and metallic parts are contained within a flexible Hypalon liner. The tubular liner itself is flanged and clamped to the exterior of the molded plastic pump body by end plates. All fluid pumped is trapped between the outside surface of the flexible liner and the interior of the pump housing. Acid is continuously rolled from inlet to discharge by an eccentric (inside the liner) connected through the end plate to the motor shaft. Stuffing boxes, shaft seals, gaskets, and check valves are eliminated. (from Elastomers Notebook, June 1957)

**Mechanical Vibrations** by Austin H. Church (John Wiley and Sons, Inc.). In any branch of engineering, many of the vibration problems that arise can be dealt with by a rational application of the basic principles of vibration analysis. This book offers a rigorous, well-organized treatment of these principles and at the same time lays the foundation for advanced work in this area.

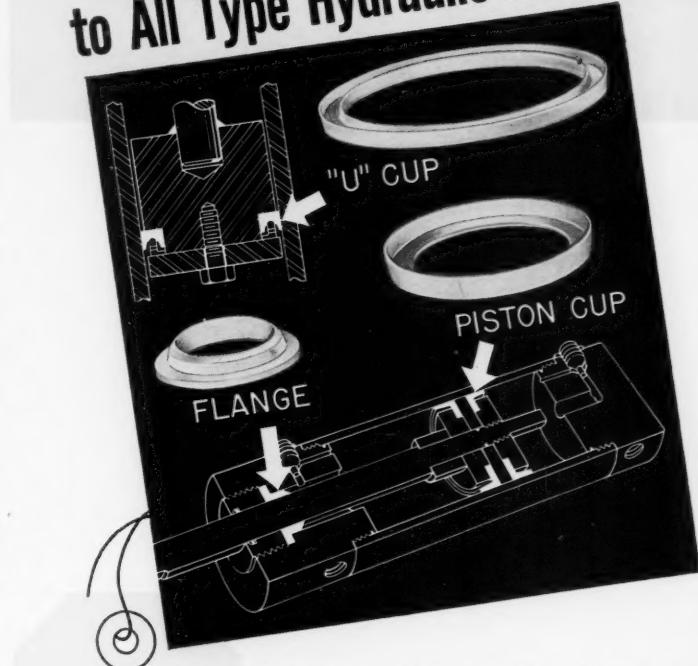
Using a mathematical and physical approach, the author stresses vector methods, the use of complex numbers, Fourier series and so on. Specific topics covered include: forced vibrations of multi-mass systems; harmonic analysis; critical torsional speeds; electrical analogies; coupling action; balancing of angle or V-engines.

### Screw threads

The threading of high temperature bolting has received attention similar to that given to materials. Early in these deliberations it was established that U.S. Standard bolt threads (known now as American Standard Coarse Thread Series) were satisfactory for diameters 1 in. and smaller. Tests were conducted on finer pitches on diameters over 1 in. as well as on other thread forms with the almost universal adoption of the 8 thread series of U.S. form. The use of 8 threads per in. provided 5% more area at the root of the thread on the 1½ in. diameter, 8.5% more area on the 1½ in. diameter and 15.2% more area on the 2 in. diameter.

(from Crane Valve World, Vol. LV, No. 2, 1957, by Paul G. Schulz)

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## New Products

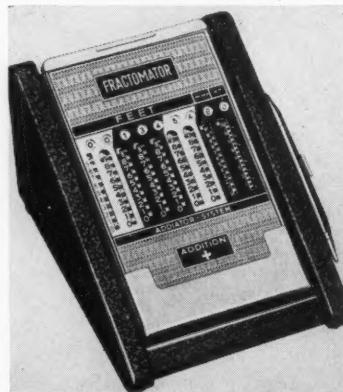
### Slides

You snap the shutter of a regular Polaroid Corporation land camera, pull a tab, and in a couple of minutes there's a finished black-and-white transparency which can be put to an infinite variety of uses immediately. That, in brief, is the story of the amazing transparency system, employing the new land projection film. It's now as easy and natural to use slides in your work as it is to pick up the telephone or dictate a letter.

The advantages of this new system are: No waiting for photographers; no waiting for conventional films to be processed; no skilled help required. Practically anyone can quickly learn the simple routines necessary to produce the transparencies; useful applications for this new system are limited only by your imagination; the slides are unsurpassed in sharpness, brilliance, range of tones, lack of graininess, even when enlarged to a 12 ft. or larger screen. (222)

### Pocket computer

Fractomator pocket-size computers can add and deduct fractions of an inch (as well as reduce fractions automatically) and change fractions into inches and



inches into feet. This is in addition to their ability to add and subtract, and count up to 100,000. Available from Kuhlmann Straube Company Ltd. (223)

### Versatile pencil

A wooden lead pencil, the All-Stabilo No. 8008, that can be sharpened to a point and writes on practically any surface (glass, metal, celluloid, wood or plastics) is a product of the Swan Pencil Company of Germany. Canadian distributor is Heinz Jordan & Company, Limited. Besides the other features, it is also

a good lay-out pencil; it is easy to erase and suitable for photoprinting and copying, on blueprints and redprints. (224)

### Motor

A new variable speed sub-fractional hp dc motor, (RBD-25), is available in two standard models from the Holtzer-Cabot division, National Pneumatic Co., Inc. One is RBD-2505 rated at .5 oz-in., volts 115 dc, rpm 1,800, watts 10; the other is RBD-2510, rating 1.0 oz-in., volts 115 dc, rpm 1,800, watts 15, as well as in voltage ranges from 24 volts to 115 volts



with speeds from 900 to 3,600 rpm. The RBD-25 is a shunt wound dc motor and a variable speed drive can therefore be obtained by varying the armature voltage.

The motor will also be offered with gear reductions in standard ratios from 3:1 to 3,600:1 with ratings the same as the standard RBC-2510 ac motor. (225)

### Inverter

Designed to operate synchronous motors rated up to 140 volt-amps input, the PV-2 (Mandrel Industrial Instruments) is a tuning fork controlled inverter, transistorized throughout. Operation is intended from a 10.5 to 13.0 volt dc source. Input current varies from 2 amps no-load to approximately 12 amps full load. The output is a modified square wave of either 50 or 60 cps repetition rate, accurate and stable to 0.01%. Its magnitude is adjustable in steps to yield 115 RMS. Complete warm-up is accomplished in 30 sec. It is also available for 24 or 48 volt sources and 400 cps output. (226)

(Continued on page 80)

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## Literature

**Formulas for Stress and Strain** by Roark (McGraw-Hill Co. of Canada Ltd.) One of the most useful books that an engineer can have on his shelves. We were recently looking at the third edition, included in which is a discussion of shear lag and formulas for circular arches. The tables of stress and deflection coefficients for flat plates have been expanded and there is now a table of coefficients for rectangular plates with large deflection. The section on pressure vessels has been extensively revised and amplified and a different example added showing the stress calculations for a thin vessel. Factors based on the work of Neuber have been included in the section on stress concentration.

**Ball bearings.** A 12-page booklet "Ball Bearing Yield and System Isoelasticity," has been prepared by The Barden Corporation, manufacturer of precision ball bearings.

The booklet is designed to assist users in the application of precision instrument bearings. It offers comprehensive background data on radial and axial play, axial take-up and preloading, as well as isoelastic bearings and achievement of system isoelasticity.

Of particular interest to gyro builders is a section on requirements for spin axis bearings subjected to transient or vibratory forces.

**Refrigeration, Air Conditioning and Cold Storage,** by Raymond C. Gunther (Chilton Company Inc.). The principles of refrigeration (and its associated subjects) are explained clearly and simply for the engineer. The material is arranged systematically, beginning with the required physics, and progressing through refrigerants, the mechanical refrigeration cycle, equipment, controls, and (finally) applications, operation and maintenance of the refrigeration system. Special chapters are devoted to brines, cold storage, lubrication and air conditioning.

Each chapter opens with a study outline and concludes with a summary. A study reference and an appendix with appropriate tables follow the text.

The book summarizes the experience of the author as an engineer and teacher. It stresses fundamentals for the student, but is equally well-suited to use by field and plant engineers and all personnel of commercial and industrial organizations whose responsibilities include operation and maintenance. (227)

**The Gray Iron Castings Handbook.** Edited by Charles F. Walton and published by Gray Iron Founders' Society, Inc. This excellent handbook on gray and ductile iron castings is one of the most informative metalworking reference books to be published. The editor (with the assistance of engineering professors, research organizations and other metalworking experts) has compiled in one volume a wealth of usable technical data for everyone in the metalworking industry concerned with the design or application of gray iron castings. Al-

though written in a practical vein, the book is of value to engineering students.

Much attention has been given in recent years to the significant technological accomplishments and progress by the gray iron industry in developing ductile (nodular), white and high alloy irons. Not until now, however, has the pick of this data appeared in one workable volume. The reader will find much useful data on how to design component parts more economically by using these new irons, as well as the many specifications for regular gray irons.

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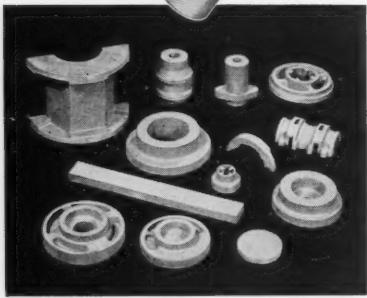
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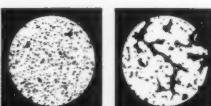
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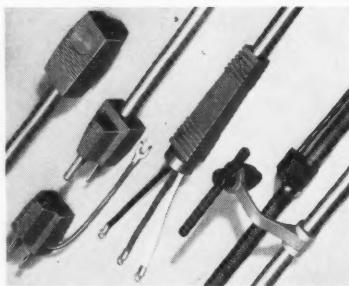
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## New products

*Continued*

### Cordsets

Style-matched design distinguishes the new cordsets and cord accessories available from **Miller Electric Company** for appliances that must be electrically grounded under recent UL and NEC rules. Plugs and connectors are of vinyl plastic, molded in one piece, bonded with the cord insulation, and can carry the manufacturer's trademark impressed in the material. For locations provided with 2-wire outlets, the adapter permits ready use of the 3-wire attachment caps



now required for safety with many power tools and appliances. Holders for chuck keys or Allen wrenches (and an improved design of strain relief) are also integrally molded with the outer insulation. The plastic material is available in a wide range of precision-matched colors, and has superior flexibility, mechanical and electrical properties, and resistance to oil and chemicals. A special vinyl is available for flexibility at very low temperatures. (228)

### Self locking clamp

A brand new idea has been added by **WedgeLock Corporation** to their line of clamping devices for industry and home workshops. Known as the Klip-Klamp, this inexpensive, fast-acting clamp has a cam trigger that sets it at five distinct positions and locks it in place. Adjust-



able from 0 to 1 in., it is released simply by flipping up the cam lever. It holds work pieces together with a powerful grip and can be clipped on and set with one hand.

The Klip-Klamp is made from extra heavy spring wire and metal parts are cadmium plated to resist rust. Replaceable rubber jaws prevent the marring or gouging of work surfaces. It can be used wherever clamps are needed to speed sawing, nailing, gluing, finishing, painting of wood, metals, plastics, fibre glass and other workable materials. Length is 4½ in., jaw depth 2 in. (229)

### Motor base

A re-engineered line of Econ-O-Matic motor bases (announced by **American Pulley Company**) provides complete automatic tension control of short-centre belt drives up to 250 bhp.

The motor is installed slightly off the pivot centre of the base, in such a way that the weight of the motor produces some slight belt tension. The amount of tension is a function of the angle of drive, the weight of the motor, the size of the sheaves and the amount of offset between the centre lines of the motor and the motor base pivot. This initial tension is held to a minimum, because it is the lowest possible in the belts at no-load (or stopped-motor) conditions. When load is applied to the motor, the distribution of belt tension is shifted from equal pull on both strands of the belt to a higher tension on the tight (bottom) side of the two strands, with a comparable decrease in tension on the upper strand.

Changes in the sum of the two belt tensions are not very large, but the line of action of the resultant of these forces moves closer to the pivot point than is true at no-load conditions. If this distance is decreased by half (for example), the tension is double its original value, for the system to be in equilibrium.

Thus, the more torque applied by the motor, the more the resultant of the belt pull shifts toward the motor base pivot point and the greater the tension in the two strands. This is exactly what is necessary to avoid slip in a drive. (230)

### Weld fasteners

A fastening device designed to cut costs and speed up assembly is the PEM self-locating weld fastener, distributed in Canada by **W. R. Watkins & Co. Ltd.** The fasteners are constructed of steel and non-corrosive, non-magnetic stainless steel for extra durability. They have many distinct advantages over former types.

They provide load-bearing threads in sheet too thin to thread. They eliminate burn-outs in thin sheets as well as complicated electrodes and pilots. (231)

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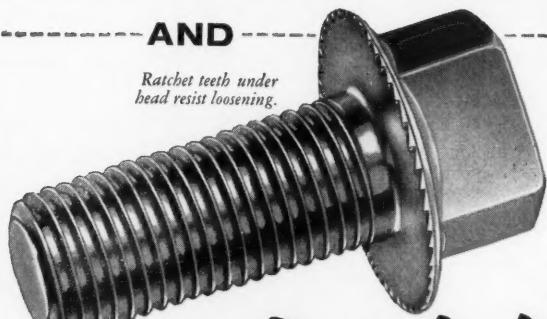
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By the provision of built-in locking devices, the two Stelco fasteners shown above reduce assembly operations, reduce inventory, and reduce wastage. Compared with standard machine screws and washers, their tighter, stronger grip often permits re-design for fewer screws. In addition, the handling and driving of single units is easier in cramped spaces.

Stelco "Sems" and "Spin-lock" Screws are available in types, sizes, and materials to suit you. For complete data, ask any Stelco Sales Office.

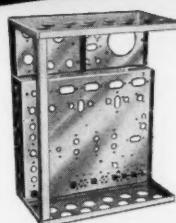
THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton and Montreal

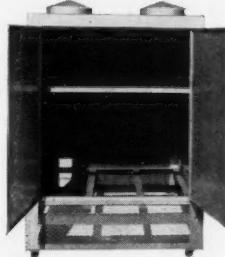
Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto,  
Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver.

57343-C J. C. Pratt & Co. Limited, St. John's, Newfoundland.

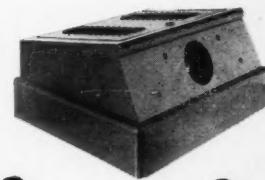
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1



3



4



5

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compromise with fabricated  
METAL EQUIPMENT

The illustrations are typical of Hammond work which can be supplied as single prototypes, or in production runs of large quantities.

- 1 Multi-punched, precision chassis built as a component for computer machines.
- 2 Midget, portable case for radio equipment, with special hinging and fastening.
- 3 Heavy duty rectifier cabinet used in control centre for automatic machinery.
- 4 Light communications equipment cabinet with complex rolled edges, rounded corners, and precise interior construction.
- 5 37½ foot long, control cabinet for automatic transfer machine in large automotive factory.

Hammond has both the facilities, and the experience to offer careful standards of quality at competitive prices. The factory will be pleased to quote on small or large quantities of original equipment, built to your own design.

Hammond manufactures and stocks many standard models of cabinets, chassis, racks and panels. For further information contact:—

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## New Products

Continued

### Thermocouples

A revised catalogue (No. 32) on thermocouple and thermocouple extension wires, is available from **Thermo Electric (Canada) Ltd.**

Listed with each type of wire are identification symbols of the calibrations and gauge sizes in which it is available. The catalogue also contains a number of useful charts with information on calibration symbols and wire color codes; wire resistances, weights and electrical properties. (232)

### Fatigue testing

Pretesting parts and assemblies weighing up to 10 lb. under "shakedown" conditions is now possible with a new vibration fatigue testing machine developed by **All American Tool & Manufacturing Company**. Any inherent weakness in a product can be quickly uncovered.

Vibration is produced on a vertical plane, in simple-harmonic-motion. Stepless acceleration is from 5 to 100 cps and the frequency ratio is 1 to 20 with a smooth power flow at all times.

A control unit to the right of the motor houses manual and automatic con-

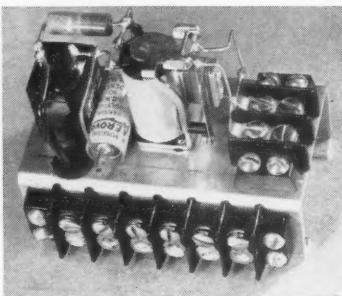
trols, tachometer and range selector. Cycling is accomplished manually merely by turning a knob to the left for low cps and to the right for high cps. An adjacent knob is turned to switch the machine to automatic operation. (233)

### Phase sequence switch

The Model 454 phase sequence switch made by **Associated Research Inc.** is an automatic control device used to protect polyphase electrical equipment from damage if connected to the line in the wrong phase sequence.

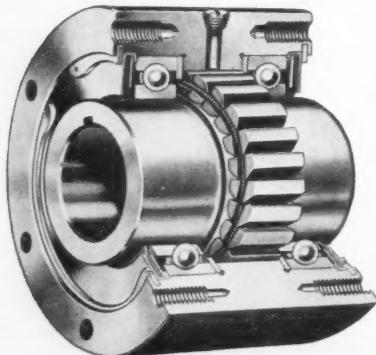
The unit consists of the necessary electrical circuitry to identify the phase sequence of the 3-phase circuit, and a relay which operates when the sequence is the reverse of the terminal designation.

A capacitor is introduced into one leg of a 3-phase Y connected circuit causing the voltage to lag the current by 90



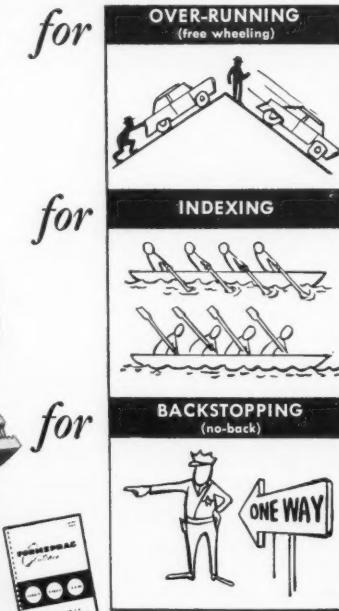
## See how the unique **FORMSPRAG** concept affords you maximum clutch performance!

In a Formsprag clutch the "D" shaped sprags afford greater contact surfaces to give increased torque capacity and better gripping to clutches for over-running (free wheeling) indexing and backstopping. Ask **RENOLD** for details.



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CANADA LTD.**

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For catalogue No. 104C write Advertising Dept., Renold Chains Canada Ltd., 1006 Mountain Street, Montreal, P.Q.

deg. The voltage is thereby shifted in the leg containing the relay, the relay operates, opening the control contacts.

In operation, the input terminals of the switch are connected to the input of the equipment being protected (across the 3-phase line). The output terminals are connected to the control or alarm circuit. If the phase sequence is ABC the relay contained in the switch remains unenergized and the normally closed contacts remain closed. Should the phase sequence become CBA, the relay energizes, opening the control contacts. (234)

### Sealing compound

Voseal electrical sealing compound in tape form, is now available from **Canadian Johns-Manville Co. Ltd.**

Joining the popular line of Dutch brand electrical tapes, it is an easy-to-handle, high dielectric insulating material used primarily to seal and build up cable splices. Voseal conforms to irregular shapes, acts as an excellent padding-insulator to round out sharp corners around terminals, connections, bus bars and motor lead junctions. (235)

### Snap action switch

The snap-action switch (S70-00A series) made by **Cherry Electrical Products Corp.**, features compact design, smallness, cheapness and unusual flexibility in electrical capacity. For printed circuit applications, the dual-purpose mounting feature provides for both electrical connection and mounting in one operation. For remote control applications, design and characteristic variations permit modifications to meet critical requirements for television remote-control units, photo equipment, microphone controls, office machines and missile applications. The contacts are made of gold-plated silver. Variations in mounting bracket, actuators and terminal shapes are available. (236)

### Gamma irradiator

Dose rates of the Gammacell 220 (**Atomic Energy of Canada Ltd.**) exceeding 1 million roentgens per hour are provided at the centre of a 220 cu. in. irradiation chamber (6 in. diameter by 7½ in. high). The Cobalt 60 radioactive source is arranged in squirrel cage configuration into which the irradiation chamber moves by push-button control. The chamber is automatically returned from the irradiate position after a preset time. Access tubes provided to the irradiation chamber permit irradiation of liquids or gases or incorporation of electrical leads. The unit weighs 7,000 lb and occupies a floor area of 16 sq ft with a maximum height of 76 in. (237)

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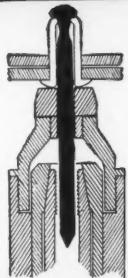
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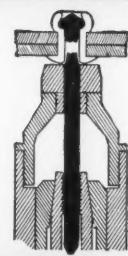
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Photograph of POP RIVET application



Rivet and Tool in Position Before Setting



After Setting—Mandrel Head Retained

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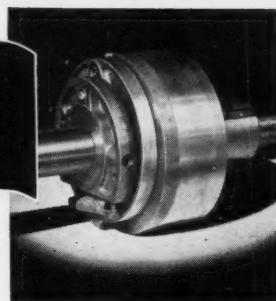
GALT

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## HILLIARD Clutches

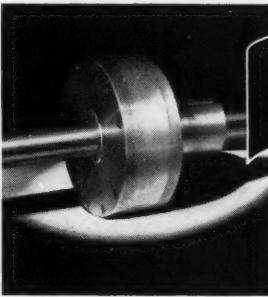
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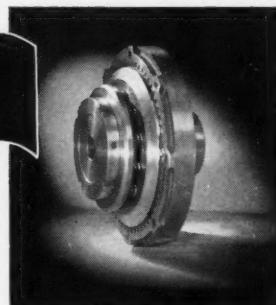
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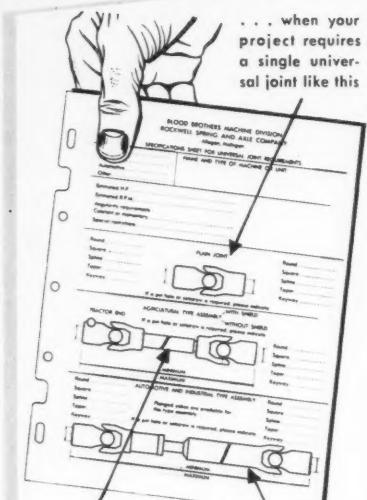


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UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

## New products *continued*

### Silicone rubber

Availability of a new series of silicone rubbers, with much greater resistance to compression set at high temperatures, has been announced by **Dow Corning Corporation**. Developed to meet the need for more reliable oil seals and gasketing materials in automotive, appliance and aircraft applications, the new rubber stocks are recommended also for many other sealing and gasketing applications involving extra high tem-

millamps to 10 amps. A choice of two time-delay curves is offered (for fast or slow-overload response) and the breaker is also available with instantaneous-trip response.

Since the SM3 combines magnetic actuation with hydraulic time delay, its current capacity and must-trip points are free from ambient temperature effects. The breaker will maintain its 125% must-trip point from -65 to  $\pm 125$ . No de-rating is necessary for temperature or vibration. The rugged, hermetically-sealed construction assures dependable operation under severe environmental conditions. (239)

### Magnetic amplifier

A magnetic amplifier for signal mixing and summing has been announced by **Acromag, Inc.**

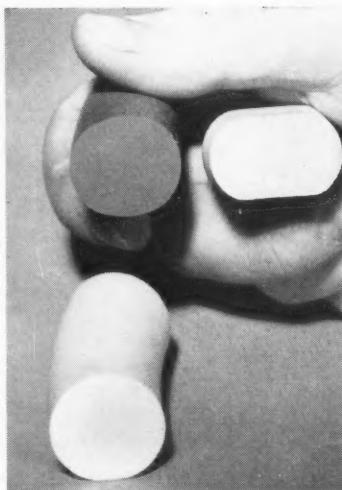
This unit (Model 410) is a completely self-contained, plug-in magnetic amplifier and power supply weighing less than 9 oz. It is designed for missile guidance, analog controls, telemetering and null-balance detectors. It operates directly from standard 115 volt, 400 cycle power.

One feature of the unit is that regulated power supplies, bias supplies and external gain and balance controls are not required; the amplifier is inherently stable. Transimpedance ( $Z_m$ ) is 25,000 ohms; 100 microampere d-c control current gives 2.5 volts d-c output; less than 10 microwatts of signal energy are required for full control; frequency response is d-c to 50 cps, depending on circuits used.

Model 410 is hermetically sealed and ruggedized, and has a standard 11-pin plug with an octal type key. (240)

### Thermostat

To meet the special requirements of the clothes dryer industry for a single-pole double-throw thermostat with heavy duty electrical rating, **Spencer Thermostat Division of Metals & Controls Corporation** is introducing the Klixon 20500 Series. Models in this series are also



peratures and high or constant pressures.

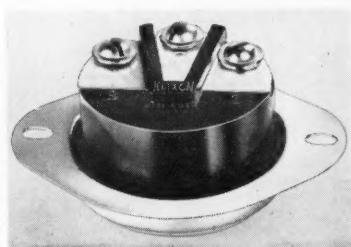
The new rubbers are also satisfactory for O-rings and similar parts in food, drug and cosmetic processing equipment. Currently, three different stocks in the new series are being produced in pilot plant quantities. Identified as Silastic S-2096U, S-2097U and S-2068U, they produce 60, 70 and 80 durometer (Shore A hardness scale) respectively. All three have a serviceable temperature range from -70 to +500 F. (238)

### Circuit breaker

Designed for the expanding trend toward subminiaturization, a hermetically-sealed circuit breaker of less than matchbox size has been developed by **Heinemann Electric Co.**

The new breaker (Model SM3) is the first of the SM series of sub-miniature breakers to go into production. This series is aimed at applications where smallness and lightness are demanded, and where stable performance is vital under varying conditions of shock, vibration and ambient temperature.

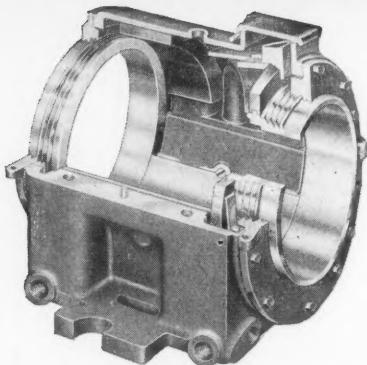
A series-overload breaker, the SM3 is designed for operation at 110 volts at either 60 or 400 cycles, or for 50 volts dc. It is available in ratings from 50



designed for large-volume applications in combination washer-dryers, electric heaters and for fan motor controls.

U/L approved electrical rating is 30 amps, non-inductive, 120/240 v-ac for a standard life of 100,000 cycles on motor loads up to  $\frac{1}{2}$  hp. Maximum operating temperatures are 300 F for 100,000 cycles and 350 F for 6,000 cycles. (241)

# Practical Application in Good Design

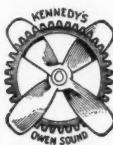


Consult Kennedy engineers concerning use of tubular castings in machine design and construction.

For example, in this Kennedy dryer bearing for paper machines, the oil-seal rings and the bearing bronze are machined from centrifugal castings.

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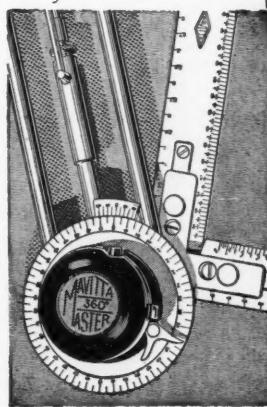
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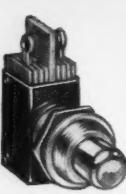
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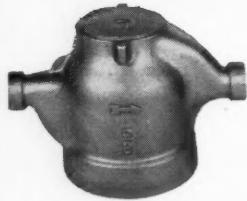
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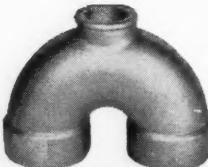
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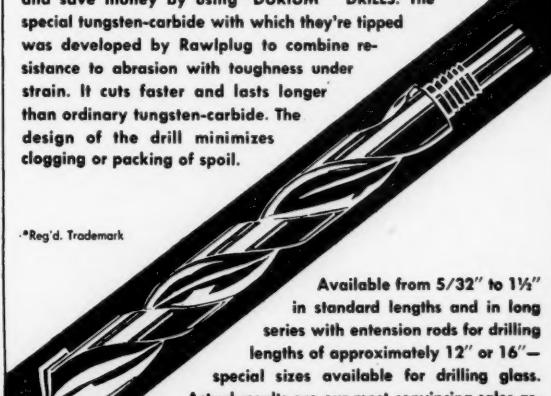
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## **Editorial**

### **Research and development needed**

"More research is required and more time for professional engineers to think and to create," states T. M. Medland in the annual report of the Association of Professional Engineers of Ontario, of which body he is executive director.

The whole business of research and development in Canada is one that we are looking into at this very moment. Before long we shall report on the subject in some detail.

#### **Creativity:**

We have many times stressed the need for more creativity and note with interest that one of the summer engineering seminars at the Pennsylvania State University (June 22) is on creative engineering. Its object: to provide information on the procedures and principles likely to assist in the production of new and fruitful ideas. It aims to stimulate creative thought in the many and varied fields of engineering.

Those engaged in research and development or product design will have the opportunity to practise under the supervision of a number of experts from companies that make use of creative engineering techniques.

Since a course of this type calls for active participation by all concerned, registrants are urged to bring "company" problems for consideration.

#### **Creativity workshop:**

Delegates to the recent annual conference of the Industrial Design Institute heard a lecture and discussion by Dr. Donald Schon called "Development of Operational Creativity," after which there was a creativity workshop, an idea that has been used by many large businesses to sift creative ideas for company application. Here, delegates were able to formulate new ideas and solutions to problems on industrial design.

#### **The rôle of the design engineer:**

The field of design engineer will be saluted by commentator Alex Dreier during a nationwide radio program on April 13, over NBC-Monitor. The program ties in with the Design Engineering Show and ASME Conference that begin on April 14 in Chicago.

The broadcast will show how the design engineer influences the way of life, since all the equipment used in our homes, shops, offices and factories is the end-product of the design engineer. Dreier will point out that the design engineer's drawing board is the point of origin for all the component parts, materials and finishes that go into such items as household appliances, automobiles, aircraft, food-handling equipment, business machinery, printing paper, textile machinery, agricultural and construction equipment.

*William Morse*



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